

**MANGO VALUE CHAIN ANALYSIS: THE CASE OF BOLOSO BOMBE
WOREDA, WOLAITA ZONE, SOUTHERN ETHIOPIA**

M.Sc. Thesis

By

Takele Honja Abate

October, 2015

Jimma, Ethiopia

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M.Sc. Thesis

**Submitted to the School of Graduate Studies, Jimma University College of Agriculture
and Veterinary Medicine in Partial Fulfillment of the Requirement for the Degree of
Master of Science in Agribusiness and Value Chain Management (ABVM)**

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October, 2015

Jimma, Ethiopia

Mango Value Chain Analysis: The Case of Boloso Bombe Woreda, Wolaita Zone,

Southern Ethiopia

I have completed my thesis work as per the approved proposal and it has been evaluated and accepted by my advisors. Hence, I kindly request the department to allow me to present the findings of my thesis and submit it.

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DEDICATION

This thesis manuscript is dedicated to my late father **Ato Honja Abate** who put me in desolation after my three weeks stay in post graduate study at Jimma University. His commitment for my triumph in the world of academics is unforgettable throughout my life time and I believe that God put his soul in paradise.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my own work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for MSc. Degree at Jimma University and is deposited at the University Library to be available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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BIOGRAPHICAL SKETCH

The author was born in 1987 in Diguna Fango Woreda, Wolaita Zone, Southern Ethiopia. He attended his elementary and junior education at Dendo Diguna and Edo Diguna primary and junior secondary schools in 2002 and 2004, respectively. Then, he completed his secondary and preparatory education at Bedessa and Boddit secondary and preparatory schools in 2006 and 2008, respectively. After completion of his secondary education, he joined Wolaita Sodo University in 2009 and graduated with Bachelor of Science Degree in Rural Development and Agricultural Extension in July, 2011. After his graduation, he has been employed at Wolaita Sodo University at graduate assistance position in 2012 and served for one year until his joining of postgraduate study in Agribusiness and Value Chain Management at Jimma University in March, 2013.

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ACRONYMS AND ABBREVIATIONS

AVC	Agricultural Value Chain
BBWARDO	Boloso Bombe Woreda Agriculture and Rural Development Office
CBE	Commercial Bank of Ethiopia
CIAT	Centro International de Agricultural Tropical (International Centre for Tropical Agriculture)
CSA	Central Statistical Agency
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistical Division
FYM	Farm Yard Manure
Ha	Hectare
JICA	Japanese International Cooperation Agency
Kg	Kilogram
Km	Kilometer
MVP	Multivariate Probit Model
NGO	Non-Governmental Organization
OLS	Ordinary Least Square
OMF	Omo Micro-Finance
OVOP	One Village One Product Promotion Project
PRA	Participatory Rural Appraisal
SNNPR	Southern Nations, Nationalities and Peoples Region
SSA	Sub-Saharan Africa
VCA	Value Chain Analysis
VIF	Variance Inflation Factor
WZFEDD	Wolaita Zone Finance and Economic Development Department

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1. INTRODUCTION

1.1. Background of the Study

Tropical and sub-tropical fruit can make a significant direct contribution to the subsistence of small-scale farmers by providing locally generate nutritious food that is often available when other agricultural crops have not yet been harvested. Fruits are a versatile product that, depending on need, can be consumed within the household or sold. Marketing fresh and processed fruit products generates income which can act as an economic buffer and seasonal safety net for poor farm households. Diversification into fruit production can generate employment and enable small-scale farmers to embark on a range of production, processing and marketing activities to complement existing income-generating activities (Clarke *et al.*, 2011).

Mango (*Mangifera indica*) is a fleshy stone fruit belonging to the genus *Mangifera*, consisting of numerous tropical fruiting trees in the flowering plant family Anacardiaceae. Mango is native to the south Asia from where it was distributed worldwide to become one of the most cultivated fruit in the tropics. Mango is produced in most frost free tropical and sub tropical climates, more than 85 countries in the world cultivate mango. Mango is one of the most widely cultivated and globally traded tropical and subtropical fruit trees in the world (ibid). The total production area of mango in the world is around 3.69 million hectares. The total amount of mango production in the world was around 35 million tons (FAO, 2009).

Mango serves as a fruit crop and as a subsistence crop for family farms. As it ripens at the end of the dry season and at the start of the rainy season, the mango is a fundamental source of nutrition for rural populations (Vayssières *et al.*, 2012). Mango fruit is an excellent source of dietary antioxidants, such as ascorbic acid, carotenoids, and especially phenolic compounds (Ma *et al.*, 2011).

In Sub-Saharan Africa (SSA), growing both domesticated and wild fruit species on farms diversifies the crop production options of small-scale farmers and can bring significant health, ecological and economic revenues (Keatinge *et al.*, 2010; Weinberger and Lumpkin, 2005). Dozens of indigenous fruit tree species although relatively unknown in global

markets, are locally of large importance for food/nutrition security and income generation. Akinnifesi *et al.* (2008) showed the high potential of many wild fruit species from different African regions for undergoing domestication followed by successful on-farm production. Fruit markets in SSA are estimated to grow substantially due to economic and human population growth and increasing urbanization rates.

Ethiopia is agro-ecologically diverse and has a total area of 1.13 million km². Many parts of the country are suitable for growing temperate, sub-tropical or tropical fruits. For example, substantial areas in the Southern and South-Western parts of the country receive sufficient rainfall to support fruits adapted to the respective climatic conditions. Ethiopia has a potential irrigable area of 3.5 million ha with net irrigation area of about 1.61 million ha, of which currently only 4.6 % is utilized (Amer, 2002).

Total fruit production in Ethiopia is about 500 thousand tones. Fruits have significant importance with a potential for domestic and export markets and industrial processing in Ethiopia. The main fruits produced and exported are banana, citrus fruits, mango, avocado, papaya and grape fruits (Zeberga, 2010). In Ethiopia mango is produced mainly in West and East of Oromia, SNNPR, Benishangul Gumuz and Amhara regions (Desta, 2005). Mango production in Ethiopia is fluctuated conditions, because of occurrence of diseases, lack of proper management and also weather conditions (CSA, 2009). More than 47 thousand hectares of land is under fruit crops in Ethiopia and mangoes contributed about 12.61% of the area allocated for fruit production and took up 12.78% of fruit production in comparison to other fruits growing in the country. However, less than 2% of the produce is exported (Joosten, 2007). Mango is one of the famous fruit crops in SNNPR. The region holds 27% of market share in Addis Ababa whole sale market and the second largest mango producing region in the country (Aithal and Wangila, 2006). The total area of land allocated for the mango production in the region is more than 3,375.89 hectare. The volume of mango production and level of productivity in the region is 343,910.27 and 101.87 quintal per year per hectare, respectively (CSA, 2013).

Wolaita Zone is one of the known mango producing Zones in the SNNPR with the total number of producers accounting about more than 131,667 private smallholder farmers with area of land allotted more than 1,152.25 hectare. Volume of mango production and productivity is 118,060.84 and 102.46 quintal per year per hectare, respectively (CSA, 2013) and holds 5% of market share in Addis Ababa wholesale mango market (Aithal and Wangila, 2006). Boloso Bombe Woreda is one of Woredas in Wolaita Zone in which mango production is carried out. This study is intended to identify actors involved in mango value chain and to draw up value chain map of the area, analyze distribution of the market margin along value chain and identify factors related with intensity of market participation and outlet choice for marketing of mango in the Boloso Bombe Woreda of Wolaita Zone, Southern Ethiopia.

1.2. Statement of the Problem

In Ethiopia mango sub-sector is a good entry point for tackling poverty and that the market for mangoes is significant and growing. Mango value chain can spur development, introduce technologies, create employment and reduce poverty among the communities. Mango fruit crop has significant importance with a potential for domestic and export markets and industrial processing (James *et al.*, 2008). However, a review of literature in agro-industry value chain in Ethiopia indicated that the sector faces many challenges due to limited market outlets, limited efforts in market linkage activities and poor market information among actors (Dereje, 2007; Kaleb, 2008; Dendena *et al.*, 2009). The largest part of the smallholder mango production is only partly marketed in the local fresh fruits markets. A multitude of factors related to the supply, quality and institutional arrangements in the value chain result in poor involvement of smallholder mango producers in market. As result of this, only a limited number of small farmers are involved in marketing and hardly any institutional arrangements in the oligopsonic wholesale markets exist (Tigist *et al.*, 2009). Correspondingly , Mamo (2009) argued that small scale, dispersed and unorganized producers are unlikely to exploit market opportunities as they cannot attain the necessary economies of scale and lack bargaining power in negotiating prices. Pedzisai (2014) indicated that understanding of the factors affecting market participation decisions as well as extent of participation and how the

bottlenecks associated with these factors can be alleviated is fundamental in improving marketing and the well being of emerging and small holder livelihood. Thus, the question of smallholder participation and level of participation in Agricultural Value Chains (AVCs) is of great importance to policymakers seeking to stimulate rural economic growth and poverty reduction (Barrett, 2008). Also Seifu (2003) indicated that development needs of fruit in general and that of mango in particular is poorly addressed in Ethiopia. With this line, the current Growth and Transformation Plan of Ethiopia (GTP) prioritizes intensive production and commercialization of horticulture as a sector for attention. Thus, the development policy initiates the need to accelerate and lucid the transformation of the sub-sector from the subsistence to business and market oriented agriculture. But, the existing restraints of post-harvest and marketing infrastructures have played their deterring role on trade and consumption of mango in Ethiopia. Thus, comprehensive data collection along the chain is a must to envisage the direction of input-output flows (Tsegaye *et al.*, 2009).

In addition to this, marketing channel decisions are among the most complex and challenging decisions facing farmers and chosen channels intimately affect all other marketing decisions (Berry, 2010). Giuliani and Padulosi (2005) indicated that systematic identification of factors faced by households in market outlet choice decision along agricultural value chain is increasingly seen by agricultural research as important component of any strategy for reaching the millennium development goals especially eradication of poverty and hunger.

But, studies conducted earlier on mango sector in Ethiopia (Elias, 2007, James *et al.*, 2008, Tigist *et al.*, 2009, Timoteos, 2009, Tiruneh, 2009, Bezabih, 2010, Ayelech, 2011, Seid and Zeru, 2013) did not touch factors affecting market outlet choice decision and intensity of market participation of small scale mango producers in spite of the fact that it is indispensable for the agricultural development programs. Moreover, despite analysis of benefit distribution is quite important for the decision making in agricultural marketing and policy analysis, information on value chain and benefit distribution along mango value chain in Ethiopia has not been addressed in sufficient manner for different parts of the country.

Mango is one of potential fruit crop produced in Boloso Bombe Woreda in Wolaita zone which has a significant contribution to the livelihood of small scale farmers in the area thereby contributing to the income of the majority of smallholder producers as well as ensuring of food security. Moreover, mango is playing a crucial role in creation of business and employment opportunities for the many firms and commercial agents in the area. Although mango production in Boloso Bombe Woreda in Southern Ethiopia is high, information related with the determinants of smallholder farmers' participation intensity, market outlet choices and distribution of market margin is lacking. Moreover, mango value chain analysis has not yet been conducted and analyzed for the target area even if there is high extent of mango production and transaction of mango from the production point to the different spatial markets. Therefore, this study was conducted with the main purpose of investigating mango value chain, identifying factors affecting farmers' intensity of participation in mango market and outlet choice and distribution of market margin along the mango value chain which will narrow the information gap on the subject and will contribute to better understanding of improved strategies for reorienting marketing system for the benefit of smallholder farmers and traders.

1.3. Research Questions

This study has addressed the following key research questions

1. Who are the major actors and what are their respective functions along mango value chain in the study area?
2. What is the benefits share of value chain actors?
3. What are the factors affecting farmers' intensity of participation in mango market?
4. What are the factors determining market outlet choice of farmers in the study area?

1.4. Objectives of the Study

1.4.1. General objective of the study

The general objective of this study was to analyze mango value chain in Boloso Bombe Woreda of Wolaita Zone, Southern Ethiopia.

1.4.2. Specific objectives of the study

1. To identify mango value chain actors and their respective functions in the study area
2. To analyze distribution of margins along mango value chain in the study area
3. To identify factors affecting intensity of farmers participation in mango market
4. To identify factors affecting market outlet choice of farmers in the study area

1.5. Scope and Limitation of the Study

This study emphasized on the major actors and their respective value adding activities (functions), distribution of benefits along the value chain and factors affecting intensity of market participation and outlet choice decision in the Boloso Bombe Woreda in Wolaita Zone of Southern Ethiopia. The other important areas of value chain analysis such as determinants of income distribution and patterns of income distribution in agricultural value chain, vertical and horizontal integration were not touched by this study. Even though the delimitation of this study is confined to the Boloso Bombe Woreda, final findings of this study will be applicable to the areas exhibiting similar socio-economic characteristics with the study area. In addition to this, this study will encompass and applicable for agricultural marketing systems possessing similar characteristics like perishability, bulkiness, low level of technology, inadequacy of infrastructural facilities and etc. The major limitation of this study is data collected may face pitfalls because of error in measurement of the variables which could not be removed entirely. In addition to this, limited knowledge and experience in management and handling of bulk data are foreseen as the major challenges of the study.

1.6. Significance of the Study

The findings of this study help policy makers and development planners, governmental and non-governmental organization and donor agencies to practice and to assess their activities and redesign their mode of operations and ultimately influence the design and implementation of policies and strategies in mango sector. It could also help different actors to identify and analyze new ways of stimulating innovation. The study will give a detailed explanation on value chain actors, their functions and chain supporters, margin share along the chain, factors hindering the intensive participation of mango producers in market and market outlet choice decision so that it will serve as a literature for individuals and researchers who are interested to engage in this particular problem to improve and find a new solution along the mango value chain in future.

1.7. Organization of the Thesis

The first chapter of this thesis deals with the background, problem statement, the objectives addressed, scope and limitation and significance of the study. The second chapter of the thesis deals with the literature review grasped on theories and basic concepts and empirical evidences. The third chapter deals with the methodological approaches applied for this study such as study area description, sampling procedures, method of data collection and analysis. The fourth chapter of the thesis deals with the results and findings obtained as per the objective of the study. The fifth chapter of the thesis deals with the conclusion and recommendations forwarded for the further improvement of mango value chain in the study area.

2. LITERATURE REVIEW

This part of the thesis deals with the detailed review of general theories, concepts, and empirical evidences indicated by other studies which guide the flow of ideas and consistency of the study.

2.1. Theories and Basic Concepts

2.1.1. Definition of value chain

The term chain refers to a supply chain indicating the process and the actors involved in the life cycle (from conception to disposal) of a product (Hawkes and Ruel, 2011). Hence, Kaplinsky and Morris (2001) defined Value Chain Analysis (VCA) as study of the “full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use”. Sanogo (2010) indicated that in addition to the movement of a product from one stage to another and identification of the actors, firms and their services also add analysis of the institutional support to production at various stages to VCA.

The concept of value chain encompasses the issues of organization and coordination, the strategies and the power relationship of the different actors in the chain. Further, a value chain exists when all the stakeholders in the chain operate in the way to maximize the generation of value along the chain (Kaplinsky and Morris, 2001). Value chain is not a vertical integration as vertical integration occurs when a single firm owns several stages in the supply chain. Rather, it is strategic network of independent organization/business who recognize their mutual need for one another working together to identify strategic objectives through sharing the associated risks and benefits by investing time, energy, and resources to make the relationship work (Hobbs *et al.*, 2000). The value chain describes the full range of activities that firms and workers perform to bring a product from its conception to end use and beyond. This includes activities such as design, production, marketing, distribution and

support to the final consumer. The activities that comprise a value chain can be contained within a single firm or divided among different firms (globalvaluechains.org, 2011).

2.1.2. Dimensions of value chain

There are four basic dimensions that Global Value Chain (GVC) methodology explores: (1) an input-output structure, which describes the process of transforming raw materials into final products; (2) a geographical consideration; (3) a governance structure, which explains how the value chain controlled; and (4) an institutional context in which the industry value chain is embedded (Gereffi, 1995). Using these four fundamental dimensions, contributions from Gereffi (1999) and Humphrey and Schmitz (2002) developed an additional element of analysis referred to as upgrading, which describes the dynamic movement within the value chain by examining how producers shift between different stages of the chain.

The input-output structure is typically represented as a set of value chain boxes connected by arrows that show the flows of tangible and intangible goods and services, which are critical to mapping the value added at different stages in the chain, and to layering in information of particular interest to the researcher (e.g., jobs, wages, gender, and the firms participating at diverse stages of the chain). The globalization of industries has been facilitated by improvement in transportation and telecommunications infrastructure and driven by demand for the most competitive inputs in each segment of the value chain. As a result, firms and workers in widely separated locations affect one another more than they have in the past (globalvaluechains.org, 2011).

Governance analysis allows one to understand how a chain is controlled and coordinated when certain actors in the chain have more power than others. Gereffi (1994) defined governance as authority and power relationship that determine how financial, material and human resources are allocated and flow within a chain. Initially in the global commodity chains framework, governance was described broadly in terms of “buyer-driven” or “producer-driven” chains.

2.1.3. Supply chain

According to Hobbs *et al.* (2000) the term supply chain refers to the entire vertical chain of activities: from production on the farm, through processing, distribution, and retailing to the consumer. In other words, it is the entire spectrum, from gate to plate, regardless of how it is organized or how it functions. The supply chain is the connected series of activities, which is concerned with planning, coordinating, and controlling material, parts, and finished goods from suppliers to customers (Steven, 1989). It is concerned with two distinct flows through the organization: materials and information. The scope of the supply chain begins with the source of commodity being supplied and ends at the point of consumption. It extends much further than simply a concern with the physical movement of material and is just as much concerned with supplier management, purchasing, materials management, manufacturing management, facilities planning, customer service and information flow as with transport and physical distribution. The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage, through to the end user form, as well as the associated information flows (Handfield and Nichols, 1999).

2.1.4. Value chain versus supply chain

Although it is impossible to make fine distinctions among these often-overlapping concepts, it is still worthwhile to provide some basic definitions. A value chain describes the full range of activities required to bring a product or service through the different phases of production, including physical transformation, the input of various producer services, and response to consumer demand (The Economist, 2007). As such, value chains include the vertically linked interdependent processes that generate value for the consumer. In contrast, the term supply chain is used internationally to encompass every activity involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer. The primary focus of supply chain is thus on cost and efficiencies in supply, while value chains focus more on value creation, innovation, product development, and marketing. While both concepts describe the same network of companies that interact to deliver goods and services, the value chain is essentially about value. The issue is not so much about which

approach is superior or preferable, since both can deliver improved business performance and productivity gains for the chain's participants (Faivre *et al.*, 2004).

2.2. Market and Marketing Concepts

Market: A market is a point or a place or sphere within which price-making force operates and exchanges of title tend to be accompanied by the actual movement of the goods affected (Backman and Davidson, 1962; Andargachew, 1990). It is the set of the actual and potential buyers of a product (Kotler and Armstrong, 2003). A market can be described as simple arrangements to facilitate exchange of one thing for another (Bain and Howells, 1988). The most observable features of a market are its pricing and exchange processes and it is more than a physical place.

Marketing: Marketing can be described as the performance of all business activities involved in the flow of food products and services from the point of initial agricultural production until they are in the hands of consumers (Kohls and Uhl, 1985; Bain and Howells, 1988). Generally, an effective and efficient marketing system enhances consumption, output and economic development. According to Kotler and Armstrong (2003), marketing is a societal process, by which individuals and groups obtain what they need and want through creating, offering, and freely exchanging products and services and value with others. Marketing is essentially a process like farming, manufacturing, mining or construction (Backman and Davidson, 1962).

Agricultural marketing: Agricultural marketing was viewed by Olukosi and Isitor (1990) and Idem (1999) as the process by which agricultural products flow physically and economically from the producers to the consumers in order to affect exchange of goods and services that satisfy the needs of individuals, groups or the entire society. In the process of marketing, buyers and sellers are linked together and can react to current situations of supply and demand. Participants thereby generate income which enhance their welfare..

2.3. Value Chain Analysis

The value chain approach is mainly a descriptive tool to look at the interactions between different actors. As a descriptive tool it has various advantages in so far it forces the analyst at considering both the micro and macro aspects involved in the production and exchange activities. Kaplinsky and Morris (2001) stress that there is no “correct” way to conduct a value-chain analysis rather, the approach taken fundamentally rests upon the research question that is being answered. Nonetheless, four aspects of value-chain analysis as applied to agriculture are particularly noteworthy.

Firstly, at its most basic level, a value chain analysis systematically maps the actors participating in the production, distribution, marketing, and sales of a particular product (or products). This mapping assesses the characteristics of actors, profit and cost structures, and flows of goods throughout the chain, employment characteristics, and the destination and volumes of domestic and foreign sales (Kaplinsky and Morris, 2001).

Second, value chain analysis can play a key role in identifying the distribution of benefits of actors in the chain. That is, through the analysis of margins and profits within the chain, one can determine who benefits from participation in the chain and which actors could benefit from increased support or organization. This is particularly important in the context of developing countries (and agriculture in particular), given concerns that the poor in particular are vulnerable to the process of globalization (Kaplinsky and Morris, 2001).

Third, value chain analysis can be used to examine the role of upgrading within the chain. Upgrading can involve improvements in quality and product design that enable producers to gain higher-value or through diversification in the product lines served. An analysis of the upgrading process includes an assessment of the profitability of actors within the chain as well as information on constraints that are currently present (Kaplinsky and Morris, 2001).

Finally, value chain analysis can highlight the role of governance in the value-chain. Governance in a value-chain refers the structure of relationships and coordination mechanisms that exist between actors in the value-chain. Governance is important from a policy perspective by identifying the institutional arrangements that may need to be targeted

to improve capabilities in the value-chain, remedy distributional distortions, and increase value-added in the sector.

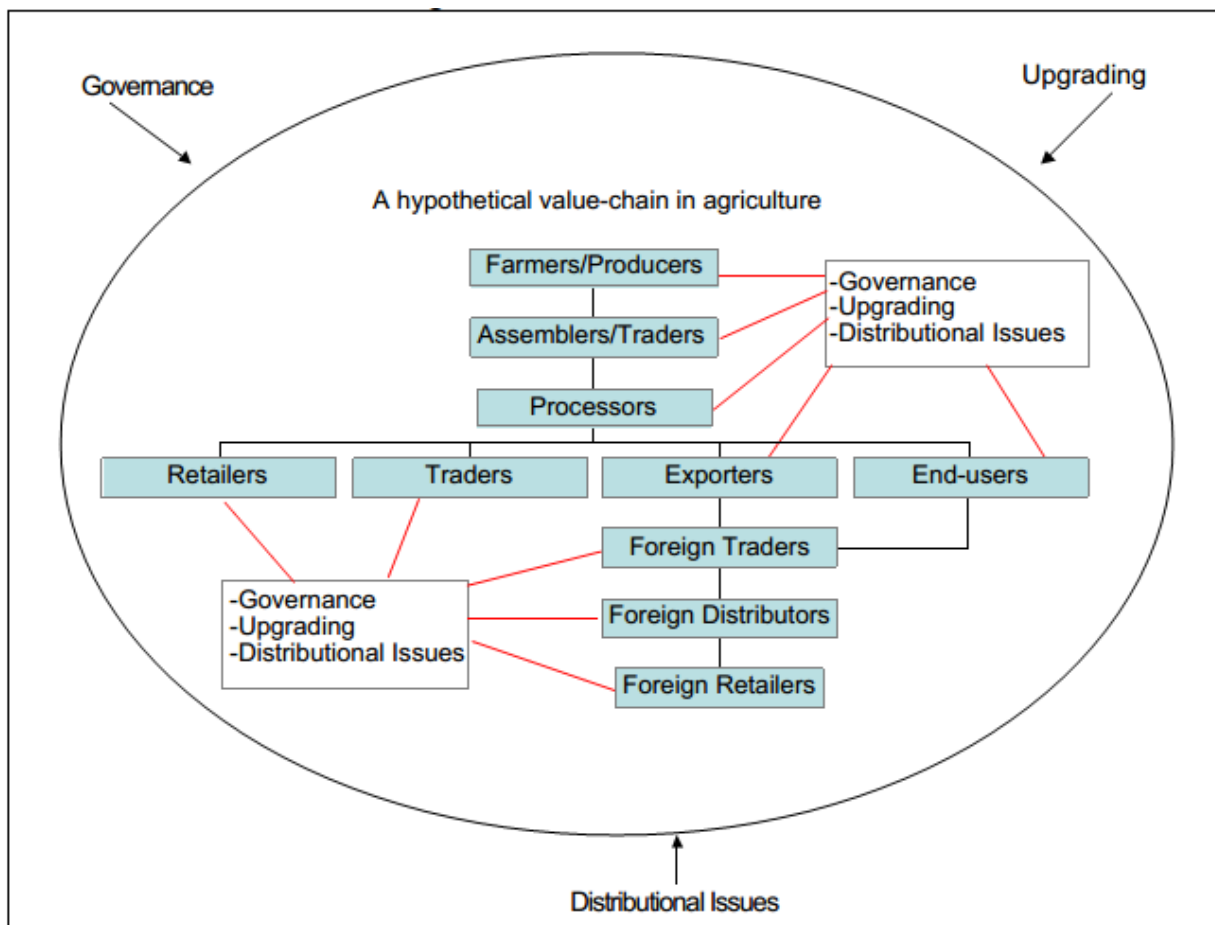


Figure 1: A Schematic representation of a value chain analysis

Source: Rich, (2004)

2.4. Value Chain Mapping

The value chain map is a conceptual and practical tool that helps us identify policy issues that may hinder or enhance the functioning of a value chain and also the institutions and organizations providing the services (such as market information and quality standards) that the different value chain actors need in order to make better informed decisions. According to (Hellin *et al.*, 2005) the value chain map is made up of three inter-linked components. These are value chain actors, enabling environment (infrastructure, policies, institutions, and

processes that shape the market environment), service providers (the business or extension services that support the value chains' operations).

2.4.1. Value chain actors

Value chain actors are those individuals or institutions that conduct transactions in a particular product as it moves through the value chain. These may include seed suppliers, farmers, traders, processors, transporters, wholesalers, retailers, and final consumers (Hellin *et al.*, 2010). In many cases, there is more than one type of source actor, as well as multiple channels that supply more than one final market. A comprehensive mapping, therefore, describes interacting and competing channels (including those that perhaps do not involve smallholder farmers at all) and the variety of final markets into which these connect. According to KIT *et al.* (2006), the direct actors are those involved in commercial activities in the chain (input suppliers, producers, traders, consumers) and indirect actors are those that provide financial or non-financial support services, such as credit agencies, business service providers, government, NGOs, cooperatives, researchers and extension agents.

2.4.2. Enabling environment and service providers

The enabling environment consists of the critical factors and trends that are shaping the value chain environment and operating conditions, but that may be amenable to change. These “enabling environment” factors are generated by structures (national and local authorities, research agencies, etc.) and institutions (policies, regulations, and practices) that are beyond the direct control of economic actors in the value chain. The purpose of charting this enabling environment is not simply to map the status quo, but to understand the trends that are affecting the entire value chain and to examine the powers and interests that are driving change. This knowledge can help determine avenues and opportunities for realistic action, lobbying, and policy entrepreneurship (Hellin *et al.*, 2010).

In most effective value chains, the actors who actually form the chain (those who conduct transactions in the main product) are supported by business and extension services from other enterprises and support organizations (e.g. seed suppliers and intermediaries). There is

an on-going need for chain actors to access services of different types, both market and technical. The third component of the value chain map framework is concerned with mapping these services that support, or could potentially support, the value chain's overall efficiency. The services that can potentially add value and determine chain actors' adoption of aflatoxin control practices and technologies include input supplies (seeds, livestock, fertilizers, etc.), market information (prices, trends, buyers, suppliers), financial services (credit, savings, or insurance institutions), transport Services (such as for grain purchasing), quality assurance (monitoring and accreditation) (Hellin *et al.*, 2010).

2.4.3. Value addition

Is simply the act of adding value to a product, whether you have grown the initial product or not. It involves taking any product from one level to the next (Fleming, 2005). It is creation of value for products at different stages and by different actors throughout the value chain. Value added related to quality, costs, delivery times, delivery flexibility, innovativeness, etc. The size of value added is decided by the end-customer's willingness to pay. Opportunities for a company to add value depend on a number of factors, such as market characteristics (size and diversity of markets) and technological capabilities of the actors (Kaplinsky and Morris, 2001). As a given commodity flows through the different segments along the chain, value is created. Value added is the difference between revenue and the cost of externally sourced material and service inputs is a node's value added (Klemperer, 1996; Tallec and Bockel, 2005). It differs from net profit by wage costs, depreciation and corporate overhead including marketing expense, interest, and taxes. As presented in Tallec and Bockel (2005), value added is not only an element of income but also represents the distribution of that income among the fundamental agents of the national economy, including households (the recipients of the return to labor), financial institutions (interest charges), government administration (taxes), and enterprises (gross or net profit).

2.5. Market Chain Analysis

A marketing chain is used to describe the numerous links that connect all actors and transactions involved in the movement of agricultural products from the farm to the consumer (Lunndy *et al.*, 2004). It is the path one good follows from their source of original production to ultimate destination for final use. Functions conducted in a marketing chain have three things in common; they use up scarce resources, they can be performed better through specialization, and they can be shifted among channel members (FAO, 2005). Market chain is the term used to describe the various links that connect all the actors and transactions involved in the movement of agricultural goods from the producer to the consumer (CIAT, 2004). Commodity chain is the chain that connects smallholder farmers to technologies that they need on one side of the chain and to the product markets of the commodity on the other side (Mazula, 2006). Market chain analysis, therefore, identifies and describes all points in the chain (producers, traders, transporters, processors, consumers), prices in and out at each point, functions performed at each point/ who does what?, market demand/ rising, constant, declining, approximate total demand in the channel, market constraints and opportunities for the products.

2.6. Marketing Outlet and Channel

A marketing outlet is a set of practices or activities necessary to transfer the ownership of goods, and to move goods, from the point of production to the point of consumption and, as such, which consists of all the institutions and all the marketing activities in the marketing process. A marketing channel can be as short as being direct from the vendor to the consumer or may include several inter-connected (usually independent but mutually dependent) intermediaries such as wholesalers, distributors, agents, retailers. Each intermediary receives the item at one pricing point and moves it to the next higher pricing point until it reaches the final buyer (Kotler *et al.*, 2004).

According to Kotler *et al.* (2004), marketing channel moves goods from producers to consumers and it fills the main time, place and possession gaps that separate goods and services from those who would use them. Members of the marketing channel perform many

key functions which include gathering and distributing marketing research and intelligence information about actors and forces in the marketing environment needed for planning and facilitating exchange, developing and spreading persuasive communications about an offer, finding and communicating with prospective buyers, shaping and fitting the offer to the buyer's needs, including such activities as manufacturing, grading, assembling and packaging, reaching an agreement on price and other terms of the offer, so that ownership or possession can be transferred. Some intermediaries help to fulfill the completed transactions through transporting and storing goods and acquiring and using funds to cover the costs of the channel work.

The question is not whether these functions need to be performed, but rather who is to perform them. The producer can eliminate or substitute institutions in the channel system, but the functions cannot be eliminated. When channel members are eliminated, their functions are moved either forward or backward in the channel, only to be assumed by other members. In short, the producers can do without intermediaries, but they cannot eliminate their functions. All these functions use up scarce resources and can often be performed better through specialization. To the extent that the manufacturer performs these functions, its costs go up and its prices have to be higher. At the same time, when some of these functions are shifted to intermediaries, the producer's costs and prices may be lower, but the intermediaries must charge more to cover the costs of their work. In dividing the work of the channel, the various functions should be assigned to the channel members that can perform them most efficiently and effectively to provide satisfactory assortments of goods to target consumers.

2.7. Measuring Market Performance

According to Abbott and Makeham (1981), market performance is how successfully the firm's aims are accomplished, which shows the assessment of how well the process of marketing is carried out. The performance of a certain market or industry depends on the conduct of its sellers and buyers which, in turn, is strongly influenced by the structure of the relevant markets (Scarborough and Kydd, 1992). Market performance can be evaluated by analyzing the costs and margins of marketing agents in different channels. A commonly used

measure of system performance is the marketing margin or price spread. Margin or spread can be a useful descriptive statistics if it used to show how the consumer's food price is divided among participants at different levels of marketing system (Getachew, 2002).

2.7.1. Marketing costs

It refers to those costs which are incurred to perform various marketing activities in the transportation of goods from producer to consumers. Marketing costs includes handling cost (packing and unpacking), costs of searching for a partner with whom to exchange, screening potential trading partners to ascertain their trustworthiness, bargaining with potential trading partners (officials) to reach an agreement, transferring the product, monitoring the agreement to see that its conditions are fulfilled, and enforcing the exchange agreement (Holloway and Ehui, 2002). Costs mentioned by Barallat *et al.* (1987) include payment for all initial assemblage, storage, processing, transporting, warehousing and retailing charges. The profit range accruable to the market participants gives an indication of market performance (Achoga and Nwagbo, 2004).

2.7.2. Marketing margin

It is a commonly used measure of the performance of a marketing system (Abbott and Makeham, 1981). It is defined as the difference between the price the consumer pays and the price that is obtained by producers, or as the price of a collection of marketing services, which is the outcome of the demand for and supply of such services (Cramers and Jensen, 1982; William and Robinson, 1990; Holt, 1993). The size of market margins is largely dependent upon a combination of the quality and quantity of marketing services provided the cost of providing such services, and the efficiency with which they are undertaken and priced. For instance, a big margin may result in little or no profit or even a loss for the seller involved depending upon the marketing costs as well as on the selling and buying prices (Mendoza, 1995). Marketing margin indicates the amount received by the different marketing agencies for providing their services. These services include grading, packing, loading/unloading, transportation, commission charges and market taxes. Net margin is left over after paying all the marketing costs. Marketing margin for a particular commodity is the

difference between what the consumer pays for the final product and the amount the producer receives (Hays, 1975; Abbott and Makeham, 1986; Olukosi and Isitor, 1990; Amobi, 1996; Arene, 2003). At each intermediary level, it is the difference between price received on resale and the purchase price (Mejeha *et al.*, 2001; Gabre-Madhin, 2001). Marketing margin reflects the costs and profit of middlemen (Olukosi and Isitor, 1990; Minot and Goletti, 2001).

2.8. Market Participation and Its Importance

Agricultural commercialization involves the transition from subsistence farming to increased market-oriented production. Market participation is the integration of subsistence farmers into the inputs and output markets of agricultural products, with the aim of increasing their income level thereby reducing poverty (Holloway and Ehui, 2002). It is commonly measured as the ratio of percentage value of marketed output to total farm production (Haddad and Bouis, 1990). As the marketed share of agricultural output increases, input utilization decisions and output combinations are progressively guided by profit maximization objectives. This process leads to the systematic substitution of non-traded inputs with purchased inputs, the gradual decline of integrated farming systems, and the emergence of specialized high-value farm enterprises (Omiti *et al.*, 2006).

Farmer participation in markets is very important in that humans derive benefits such as income and rural employment from farming (Ngqangweni, 2000), in other words farming in rural areas act as a form of employment for the rural people and help in income generation. However, beyond production activities, producer participation in marketing allows for the transition from subsistence farming to commercial farming (Makhura *et al.*, 2001). Farmers that participate more in selling their produce are more likely to advance from lower scale e.g. small scale producers to larger scale producers. This commercializing environment is essential for providing an incentive for increased production and thus, for improved welfare of emerging and smallholder farmers. In addition marketing activities such as processing, transportation and selling can provide employment for those willing to exit the farming sector. According to Jari (2009) farmer market participation is important both for sustainable

economic growth and for the alleviation of poverty and inequality. In summary, marketing plays a critical role in meeting the overall goals of food security, poverty alleviation and sustainable agriculture, particularly among smallholder farmers in developing countries.

2.9.Theoretical Reviews on Determinants of Market Participation

Market participation should be enhanced to increase the marketable surplus. Barret (2008) argued that technology affects market participation directly. A household's production technology choice affects its market participation choice by affecting its productivity. Wilson *et al.* (1995) suggested that due to lack of storage facilities, most smallholder producers are keen to sell produce almost immediately after harvest in order to ease congestion, leading them to sell their produce at lower prices. Market infrastructure such as sheds and stalls in the spot market is crucial in maintaining freshness of agricultural producers (Wilson *et al.*, 1995). Also improved market access result in the production of marketable surplus and hence gain in income from agriculture and higher revenues, saving and hence investment in productivity enhancing technologies. According to Matungul *et al.* (2002), investment in public goods such as telecommunication, road, an efficient legal system, and farmer support service (extension, marketing information, and research) would raise farm and non-farm income by reducing transaction costs.

The main forces that generally drive commercialization include an increased market demand for food arising largely from population growth and demographic change; urbanization; the development of infrastructure and market institutions; the development of the non-farm sector and broader economy; rising labor opportunity costs; and macroeconomic, trade and sectoral policies affecting these forces (Pingali and Rosegrant, 1995). At the farm level, commercialization is mainly affected by agro-climatic conditions and risks; access to markets and infrastructure; community and household resource and asset endowments; the development of local commodity, input, and factor markets; laws and institutions; and cultural and social factors affecting consumption preferences, production, and market opportunities and constraints (Pender *et al.*, 2006). These factors affect commercialization by altering the conditions of commodity supply and demand, output and input prices, and transaction costs and

risks faced by farmers, traders and others in the agricultural production and marketing system (Pender and Alemu, 2007).

Contract system is another strategy to enhance market participation. Contract farming provides the basis for sharing values, risks and decision-making power between farmers and processors in a way that is mutually beneficial (Eaton and Shepherd, 2001). Across many developing countries, contract farming has been found to play an important role in the commercialization of smallholder agriculture through the provision of an assured market, high prices, critical inputs and knowledge of new agricultural technologies for farmers as a driver of a rural development strategy (Elupe and Nalukenge, 2007). As cited by Kherallah and Kirsten (2001), collective action is also an important strategy in agricultural marketing because it contributes towards reduced transaction costs and it strengthens the farmer's bargaining and lobbying power.

2.10. Empirical Studies on Measuring Market performance

Lashari *et al.* (2003) provided various performance measures to estimate the efficiency of fruits and vegetables supply chains in Pakistan. These measures included marketing margin, absolute margin, break down of consumer rupee, marketing cost and net margin. Ayelech (2011) used Total Gross Marketing Margin (TGMM) in her study of market chain analysis of fruits in Jimma zone; Ethiopia to estimate share of market margin among the chain actors and indicated that 88.89%, 77.78% and 67.32% TGMM of consumers' price goes to retailers, wholesalers and processors, respectively. According to her study, producers share in consumer price is less than 20% in all channels except in channel I, V and VI. Abraham (2013) who has conducted study on vegetables value chain in Habro and Kombolcha woreda in Oromia region has indicated margin analysis for actors along vegetable value chain in the area. He used TGMM, NMM, and GMM to analyze market margin for actors in tomato value chain and indicated that about 22.5%, 20.2% 19.4%, 19.1% and 18.9% share of market margin in tomato value chain goes to urban retailers, rural retailers, producers, collectors and wholesalers, respectively.

2.11. Empirical Evidence on Determinants of Intensity of Market Participation

Tewodros (2014) used Tobit model to identify determinants of smallholder pulse producers' market orientation in Southern Ethiopia and indicated that household head education level, access to credit and land per capita positively influenced chickpea market orientation while being male head of a household and accesses to credit increased the predicted value of haricot bean market orientation. Adetola *et al.* (2014) identified determinants of market participation among maize producers in Oyo State, Nigeria by using censored Tobit regression. The study has revealed that market price, member of a producer group, farm size, educational and total maize produced, road condition, primary occupation and transaction costs significantly affect farmers' market participation. Adenegan *et al.* (2013) used Tobit regression and indicated that variables such as age, education, gender and distance to the market determined the market orientation of smallholder cassava producers in Nigeria. Gender represents differences in market orientation between male and female heads of households. Edward *et al.* (2012) also used Tobit model to identify factors influencing the intensity of commercialization by farm households in Ghana and indicated that output price, farm size, access to extension service, distance to the nearest market and market information determine household commercialization. Adenegan *et al.* (2012) identified determinants of market participation of maize farmers in rural Osun State of Nigeria by using Tobit model and indicated that quantity of maize produced, age, household size, farming experience, ownership of farming equipment, access to non-farm income, farmers' association, means of information and transportation cost determined market participation significantly

Gebremedhin *et al.* (2010) used Tobit model to identify determinants of the household participation in crop output market as seller and indicated that education, oxen owned by the households, other tropical livestock units and distance from the nearest market centre are the significant determinants of households' participation in crop output markets. Komarek (2010) found that sub-county prices in Uganda had stronger influence on initial market entry decisions while quantities had a larger impact on volumes traded. Omiti *et al.* (2009) indicated that distance from farm to point of sale was a major constraint to the intensity of market participation while better output price and market information were key incentives

for increased sales. Cunningham *et al.* (2008) found that men are likely to sell more grain early in the season when prices are still high, while women prefer to store more output for household self-sufficiency. The household size explains the family labor supply for production and household consumption levels (Alene *et al.*, 2008). A positive sign implies that a larger household provides cheaper labor and produces more output in absolute terms such that the proportion sold remains higher than the proportion consumed. A negative sign on the other hand means that a larger household is labor-inefficient and produces less output but consumes a higher proportion, leaving smaller and decreasing proportions for sale. Alene *et al.* (2008) also noted that non-farm income contributes to more marketed output if the non-farm income is invested in farm technology and other farm improvements. Otherwise, marketed farm output drops if non-farm income triggers off-farm diversification. The study also indicated that output price is an incentive for sellers to supply more to the market. Also Guitierrez (2003) indicated that female headed household is more likely to be resource constrained hence affecting production of marketable surplus. Human capital, represented by the household head's formal education is posited to increase a household's understanding of market dynamics and therefore improve decisions about the amount of output sold, *inter alia* (Makhura *et al.*, 2001). Key *et al.* (2000) found that distance to the market negatively influences both the decision to participate in markets and the proportion of output sold.

2.12. Empirical Evidences on Factors Affecting Market Outlet Choices

The choice of the channel to use is a fundamental decision for the producer where a number of factors and objectives have to be considered as a basis for such a decision. Several authors carried out different studies to identify factors that influence the producer's choice of marketing outlet. Alessandro *et al.* (2009) have used a multivariate probit model to identify factors affecting market outlet choices among organic producers in Italy. The study indicated that education and professional training, age, distance to the consumer market (location) and type of farming have significantly affected the choice of direct, short and traditional marketing chains. Narayan and Jeffery (2011) have used a multivariate probit model to

identify factors influencing producers' marketing decisions in the Louisiana crawfish industry. The study indicated that farm size, farm income, household income, age, education, and pre-market grading and washing operations significantly affected farmer selection of marketing outlet. Djalalou-Dine *et al.* (2014) identified the smallholder farmers' selection of marketing channels in Beninese by using multivariate probit model and indicated that variables such as education, age, production system, quality requirement, distance to the market and presence of incentives determined smallholder farmers' choice of rural, urban, export and processing market outlets.

Agarwal and Ramaswami (1992) has used multinomial logit model and identified that factors such as price, production scale and size, farm household characteristic, behavioral aspects such as (trust, risk, and experience), and market context (distance and purchase condition) affect producer market outlet choice. Geoffrey *et al.* (2014) identified determinants of market outlet choices of small scale pineapple producers in Kenya by using multinomial logit model. The study has indicated that gender, group marketing, pineapple yield, price information, marketing under contract and vehicle ownership significantly influenced the choice of pineapple marketing outlets. Zuniga-Arias (2007) who has also used multinomial logit model and found out that factors such as price attributes, production system, farm household characteristic, and market context could affect market outlet decision of farmers in mango supply chain in Costa Rica. Hobbs (1997) found out that age, education, farm profit and transaction cost are some factors that influence farmers channel choice decision in livestock marketing.

Makhura *et al.* (2001) reported that gender affects market channel participation for maize in the Northern Province of South Africa since most males use direct channel as they prefer instant cash for leisure. A study conducted by Sourgiannis (2008) found out that farm and farm characteristics, volume of milk production, farm income, debt, sales price, speed of payment and loyalty have a significant effect on market channel choice of sheep and goat farmers in the region of east Macedonia in Greece. Mburu *et al.* (2007) used multinomial logit model and found that producer characteristics including ownership, age of the cattle farmers, education level of the cattle farmers positively and significantly influenced marketing channel choice while farming experience of the farmers had a negative influence.

Knowledge of prices is another factor which mainly arises due to imperfect information. Asymmetric information may give such actors an exploitable advantage in their dealings with other parties hence transaction costs arise (Klein *et al.*, 1990; Loader, 1997). The speed of payment which is defined as the lag between the time when the product is sold and the time when the payment is received is also one of the important waiting costs. It was reported that higher speed of payment will increase the probability of farmers to participate in a particular channel (Nkhori, 2004; Gong *et al.*, 2007). It was further reported that the higher the level of education, the higher the probability to enter into an arrangement with a large dairy company since one is more capable to manage their farm and subsequently supply milk with higher levels (Voors, 2006; Gong *et al.*, 2007). Chen *et al.* (2006) recommends that transaction cost is a viable theory to explain the acquisition decision in marketing channels. In a study analysis of cattle marketing, Musemwa *et al.* (2007) observed that experience of farmer in keeping cattle affected the choice of marketing channel.

Jari and Fraser (2009) identified that market information, expertise on grades and standards, contractual agreements, social capital, market infrastructure, group participation and tradition significantly influence household marketing behavior. Rao *et al.* (2010) confirmed that educational level of the operator, off-farm employment, own means of transportation and age of operator had positive effect whereas household size was negatively associated with supper marketing channel choices.

3. METHODOLOGY OF THE STUDY

This chapter deals with the research methodology that was used in this study which includes location and description of the study area, data types and sources, sampling techniques and sample size determination, methods of data collection and analysis and tentative explanations forwarded on the nature and relationship between dependent and independent variables.

3.1. Description of the Study Area

Boloso Bombe Woreda is one of the 12 Woredas in Wolaita Zone, SNNPR. The area is situated along Ajora falls in Wolaita Zone with a capital town of Bombe which is located 325 km and 55 km away from Addis Ababa and Wolaita Sodo town through Hossana exit, respectively. The relative location of the Woreda is Kambata Tambaro at North, Boloso Sore Woreda at East, Sodo Zuria and Kindo Koysa Woreda at South, and Damot Sore woreda at West. Astronomically, the area locates 7.03-7.19 North (Latitude) and 37.44-37.66 East (Longitude). The altitude of the Woreda is 501-2500 meter above sea level. The total area of the Woreda is 272.2 square km and contains 18 rural kebeles and 2 town kebeles in total of 20 kebele administrations (WZFEDD, 2014).

The population size of the Woreda is 106,898 from which male and female account 52,078 and 54,820, respectively. About 50%, 48.3% and 1.6% of the population of the Woreda is under the age interval of 0-14, 15-65 and above 65 year, respectively indicating that majority of population is under young and productive age category and more than half of the population is under the dependency age structure (WZFEDD, 2014).

The amount, duration and intensity of rainfall in the Woreda vary considerably. The climatic data of the area shows that the area gets a mean annual rainfall of 1200-1600 mm per year and mean annual temperature ranging from 12.6-25⁰c in a year. The Woreda has diverse agro-ecological zones ranging from kola to dega. From the total area dega accounts 14.28 %, woyna dega accounts 23.44 % and kola accounts 62.28% (WZFEDD, 2014).

The Woreda is characterized by subsistence mixed farming system in which production of both crops and livestock is common economic activity. Due to varied agro-ecology of the area, major agricultural crops growing in the area may include cereals, legumes, vegetables, root crops, perennials and fruits, etc. Commonly produced crops in the area may include maize, teff, coffee; root crops such as sweet potato, yam, taro; haricot bean, enset, and fruits. Agricultural production system is relying on traditional method in which tame animals such as oxen supply drought power. There is tendency of making the system modernized in terms of technological input adoption such as, improved varieties, fertilizer, chemicals, etc. Livelihood system of the area is mainly based on agriculture. Small scale trade, off-farm and non-farm activities are also serving as the way of sustaining life and meeting basic needs for the certain portion of population in the area (WZFEEDD, 2014).

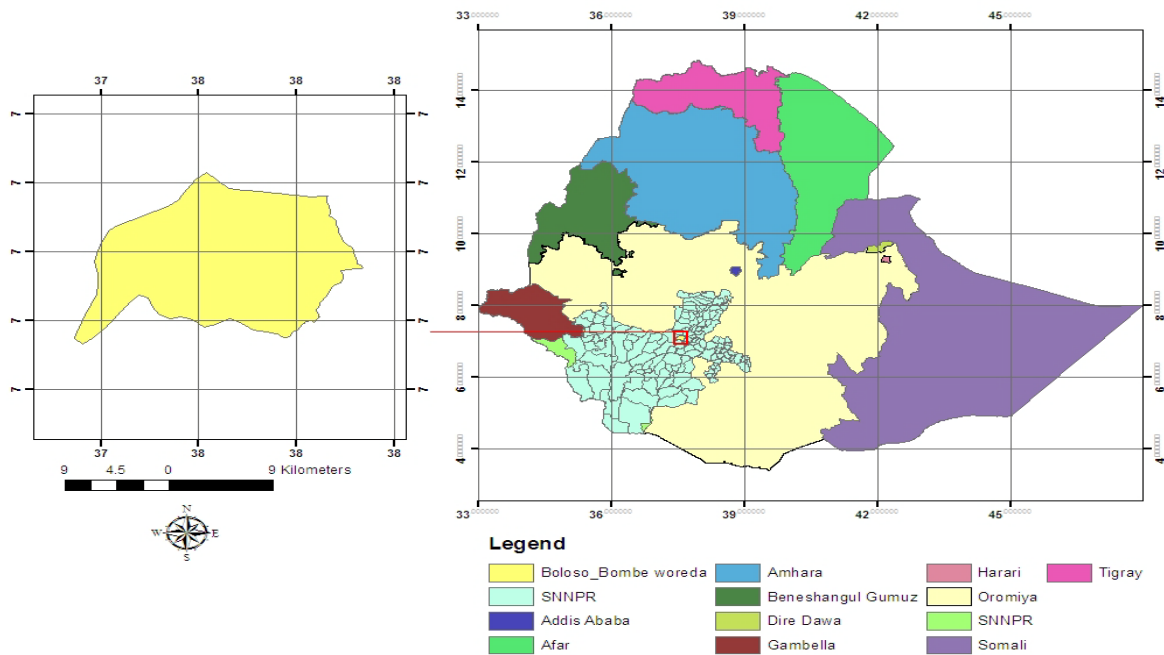


Figure 2: Location map of the study area

3.2. Sample Size Determination and Sampling Techniques

The sample for this study was drawn from all actors involved along mango value chain such as producers, rural collectors, wholesalers, processors, retailers and consumers. Based on their distribution, mango value chain actors have been selected by using their appropriate sampling techniques.

Producer's sampling

Boloso Bombe Woreda was selected purposively as the study area based on the extent of mango production and participation of farmers in mango marketing. There are 18 rural kebele administrations in the Boloso Bombe Woreda. From these rural kebele administrations, 4 kebele administrations were selected randomly. Accordingly, Adila, Bombe, Mehal Ambe and Para wocha kebele administrations were selected randomly. There are about 1150, 1210, 1220, and 1360 mango producers in Adila, Mehal Ambe, Bombe and Para Wocha kebele administration, respectively. Sample frame was drawn for the study population of selected kebele administration and by employing Probability Proportional to Size (PPS), the number of farmers taken from each kebele was determined. Finally, based on the sampling frame drawn from each kebele administration, simple random sampling technique was applied to select the sample mango producing farmers. In addition to the purpose of the study and population size, three criteria usually need to be specified to determine the appropriate sample size: the level of precision, the level of confidence or risk and the degree of variability in the attributes being measured (Miaoulis and Michener, 1976). Since population in the selected kebele administrations is greater than 1,000, Cochran (1963) sample determination formula was adopted to determine sample representatives of the study population.

$$n = \frac{z^2 p(1-p)}{d^2} \dots\dots\dots (1)$$

Where: n = is the sample size, Z^2 = is equals the desired confidence level at 95% which is 1.96, d is the desired level of precision which is 5%, p is the estimated proportion of an

attribute (homogeneity of the study population) that is present in the mango producers at 10%, and q is $1-p$. The value for Z is found in statistical tables which contain the area under the normal curve. Accordingly, 138 mango producers were selected from the selected kebele administrations.

Table 1: Sample size determination of mango producers

Kebele	Number of mango producers (N)	Proportion (%)	Sample size (n)
Adila	1,150	0.23	32
Bombe	1,210	0.245	34
Mehal Ambe	1,220	0.25	34
Para Wocha	1,360	0.275	38
Total	4,940	1.000	138

Source: BBWARDO (2015)

Trader's sampling

This survey includes intermediary value chain actors involved in mango marketing such as wholesalers, assemblers, retailers, processors and consumers. Selection of these actors is range from the study area to the major towns and marketing centers such as Bombe town, Areka town and Sodo town in Wolaita zone. These actors were selected purposively based on their direct involvement in the mango value chain coming from the production point of the study area up to the final market. Because of lack of secondary data record on mango traders, traceability and snow ball sampling technique was employed to select wholesalers, collectors and processors. Retailers were selected randomly from Bombe town market. Accordingly, 10 wholesalers, 12 retailers, 6 collectors and 7 processors were selected purposively based on their involvement in transaction of mango originating from the study Woreda. About 25 consumers were selected randomly from the study area and major towns in the Wolaita Zone.

3.3. Types, Sources and Methods of Data Collection

3.3.1.Types of data

To conduct this study, both qualitative and quantitative types of data were used. Qualitative data collected may include actors and their respective functions, marketing condition, support services aligned along value chain, socio-economic characteristics of mango producers, mango production systems, value additions, mango distribution pattern, market outlets available in the area, etc. Quantitative data like direct and overhead costs incurred by each actor, market margin, postharvest loss, percentage share of mango among actors, income from sale of mango, volume of mango production, age of the actors, volume of mango sold and bought, selling and buying price of the mango in unit of measurement, distance to the market, other sources of income, etc. were collected.

3.3.2. Sources of data

The study used both primary and secondary sources of the data that are consistent, available, adequate and reliable for the objectives intended to be addressed. The primary sources of the data include sample respondents, key informants, extension workers, agricultural office workers and mango traders and consumers. Accordingly, data on production and constraints, transportation, storage, product handling, prices, marketing systems and constraints, consumption, mango marketing and distribution, etc were collected. Secondary sources of data include statistical abstracts, reports, journals and documents of Woreda Agriculture and Rural Development Office and Marketing and Cooperative Office.

3.3.3. Method of data collection

To capture adequate data for the study, both close ended and open ended (semi- structured) questionnaire was prepared. To collect the data, personal interview and Participatory Rural Appraisal (PRA) tools such as focus group discussion and key informant interview were

used. Enumerators who have college diploma and working as development agents were recruited and trained for data collection. Before data collection, the questionnaire was pretested on five farmers and three traders to evaluate the appropriateness of the design, clarity and interpretation of the questions, relevance of the questions and time taken for an interview. Hence, appropriate modifications and corrections were made on the questionnaire based on the feedback obtained. Data were collected under continuous supervision of the researcher. Document review was made to take secondary data related with the study.

3.4. Method of Data Analysis

To change the raw data of the study into fact, both descriptive and inferential statistics were used. Descriptive statistics such as frequency, mean, percentage, and standard deviation were used in the process of comparing socio-economic, demographic and institutional characteristics of households. In addition to this, descriptive tools such as tables, figures and graphs were used to present the results. Inferential statistics such as t-test, chi-square test, F-test (log-likelihood ratio test), Wald test, pseudo R^2 and P-value were used to test adequacy of the model and hypothesis for the statistical significance of parameters and variation among the sample households. Maps in the process of examining and describing marketing functions, facilities, services, and household characteristics were used to illustrate the overall system of mango production and marketing in the area.

3.4.1. Descriptive analysis

Mapping value chain

To illustrate the value chain map of the study area, various procedures of value chain mapping were adopted as an analytical tool. Drawing value chain map has gone through the following steps. In the first step the core processes in the value chain were identified. After identification of value chain process, identifying and mapping the main actors involved in their respective functions was conducted. In the third step, mapping flows of products, information and knowledge was made followed by mapping of the processes, actors and

specific functions along the chain. The reason for the existence of value chain is that goods, services or information is passed on between different actors. In the fourth step mapping the geographical flow of the product or service was made. Finally, mapping business services that feed into the value chain was identified and connected with their respective beneficiaries. Mapping these services gives an overview of the potential for interventions outside the value chain itself.

Analyzing marketing margins

Cost and price information is used to construct marketing cost and margin. Computing the Total Gross Marketing Margin (TGMM) is always related to the final price paid by the end buyer and is expressed as percentage (Mendoza, 1995).

$$TGMM = \frac{\text{End buyer price} - \text{first seller price}}{\text{End buyer price}} \times 100 \dots \dots \dots (2)$$

Where, TGMM is total gross marketing margin. It is useful to introduce the idea of Producers' Gross Margin (GMMp) which is the portion of the price paid by the consumer that goes to the producer. The producers' margin is calculated as:

$$GMMp = \frac{\text{End buyer price} - \text{Gross marketing margin}}{\text{End buyer price}} \times 100 \dots \dots \dots (3)$$

Where, GMMp = the producer's share in consumer price

The Net Marketing Margin (NMM) is the percentage of the final price earned by the intermediaries as their net income after their marketing costs are deducted. The percentages of net income that can be classified as pure profit (i.e. return on capital) depends on the extension to such factors as the intermediaries' own (working capital) costs. The equation tells us that a higher marketing margin diminishes the producer's share and vice versa. It also provides an indication of welfare distribution among production and marketing agents.

$$\text{NMM} = \frac{\text{Gross marketing margin} - \text{Marketing cost}}{\text{End buyer price}} \times 100 \dots\dots\dots (4)$$

Where, NMM is the net marketing margin

Higher NMM or profit of the marketing intermediaries reflects reduced downward and unfair income distribution, which depresses market participation of smallholders.

3.4.2. Econometric analysis

Intensity of Market participation

Majority of the smallholder farmers in the study area practiced mango production both for food and as a source of income. A large proportion of the farmers therefore participated in mango marketing; however, the degree of participation varies among households. This situation disqualified two step procedures like Heckman or Double Hurdle model in analysis of the data because of a fewer number of non-participants in mango market. Because of the predetermined selection of households based on production and marketing of mango in the study area, the data collected did not allow use of selectivity models. The model assumes that the decision to sell and the actual sales level were simultaneously determined by the same variables such that the variables that increased the probability of selling also increase the total amount of output sold. Tobit interprets all the zero observations as corner solutions where the household is assumed to be a mango seller with zero sales. The aim of the study was to look at factors that increase the level of farmers' participation in the mango market. Ideally, the Ordinary Least Square (OLS) model is applicable when all households participate in the market but in reality not all households participate or at the same level in the market. Some households may not prefer to participate in a particular market in favor of another, while others may be excluded by market conditions. If the OLS regression is estimated excluding the non-participants from the analysis, a sample selectivity bias is introduced into the model. Therefore, Tobit model was used to identify determinants of smallholder farmers' intensity of participation in mango market. This study purposively analyzed the intensity of market participation in order to trace factors that influence the degree of market participation among households in the study area. The observed

amount of mango output Y_i^* that is actually sold in the market was used as a relevant proxy for intensity of market participation. The focus on intensity of participation would enable the identification of variations among the household specific mango output sale. The decision to participate in mango market and the intensity of participation were thus jointly determined (Sindi, 2008). The model assumes normal distribution with constant variance (Greene, 2003) and was specified as shown in equations below.

$$\begin{aligned}
 y_i^* &= x_i' \beta + \epsilon_i, \epsilon_i \sim N(0, \delta^2) \\
 y_i &= 0 \text{ if } y_i^* \leq 0 \\
 y_i &= y_i^* \text{ if } y_i^* > 0 \dots\dots\dots (5)
 \end{aligned}$$

Where, y_i was the proportion of mango sold by a farmer and it took a continuous value between 0 and 1. β was a vector of factors explaining values of the dependent variable and ϵ_i is error term which is assumed to be normally distributed. It may not be sensible to interpret the coefficients of a Tobit in the same way as one interprets coefficients in an uncensored linear model (Johnston and Dinardo, 1997). Hence, one has to compute the derivatives of the estimated Tobit model to predict the effects of changes in the exogenous variables. Thus, a change in X_i (explanatory variables) has two effects. It affects the conditional mean of Y_i^* in the positive part of the distribution, and it affects the probability that the observation will fall in that part of the distribution. The marginal effect of an explanatory variable on the expected value of the dependent variable is:

$$\frac{\partial E(Y_i)}{\partial x_i} = F(z) \beta_i \dots\dots\dots (6)$$

Where, $\frac{\beta_i x_i}{\sigma}$ is denoted by Z following Maddala (1997).

The change in the probability of participation as independent variable X_i changes is:

$$\frac{\partial F(Z)}{\partial X_i} = f(z) \frac{\beta_i}{\sigma} \dots\dots\dots (7)$$

The change in intensity of market participation with respect to a change in an explanatory variable among participants is:

$$\frac{\partial E(Y_i/Y_i > 0)}{\partial X_i} = \beta_i \left[1 - Z \frac{f(z)}{F(z)} - \left(\frac{f(z)}{F(z)} \right)^2 \right] \dots\dots\dots (8)$$

Where, F(z) is the cumulative normal distribution of Z, f(z) is the value of the derivative of the normal curve at a given point (that is, unit normal density), Z is the z-score for the area under normal curve, β is a vector of Tobit maximum likelihood estimates and σ is the standard error of the error term.

Specification of market outlet choice model

Determinants of the market outlet choices were identified by using multivariate probit model. Some recent empirical studies of market outlet choices assume that farmers consider a set (or bundle) of possible outlets and choose the particular marketing outlet that maximizes expected utility. They also assume that the addition or deletion of alternative outcome categories does not affect the odds among the remaining outcomes and the odds of choosing a particular market outlet over the other do not depend on which other outcomes are possibly chosen. However, in the present study more than one marketing outlet is available in the study area and farmers are more likely to simultaneously choose more than one market outlet in order to address their multiple needs. In this case, the dependent variables are the dichotomous variables indicating whether sales are made through the relevant marketing chain. The market outlets have been categorized into four groups: wholesaler, collector, retailer and consumer market outlets. Each farmer can use one or more marketing outlets or several combinations of different outlets which maximize the expected utility and due to this there is some overlapping and many farmers sell on more than one market outlet. This is to mean that farmers do not sell mango permanently to the particular market outlet and use the available market outlets alternatively in the absence or presence of the possible choices. Since farmers may market their mango via multiple outlets, the multinomial logit model would be infeasible due to the resultant very large number of possible choices. The relative

risk of selecting one outlet can be affected by the relative risk of the selecting the other and violate the Hausman assumption of Independence of Irrelevant Alternatives (IIA) in multinomial logit model. If simultaneity in decision-making exists, this approach yields biased, inefficient and inconsistent estimates (Maddala, 1983; Greene, 2003). Thus, the decision of choosing market outlets is inherently multivariate and attempting univariate modeling excludes useful economic information contained in interdependent and simultaneous choice decisions. Failure to capture unobserved factors and inter-relationships among choice decisions regarding different market outlets will lead to bias and inefficient estimates (Menale *et al.*, 2012).

The multivariate probit model takes into account the potential interdependence in market outlet choices and the possible correlation in the choice of alternative outlets. The probability of preferring of any particular market outlet is estimated conditional on the choice of any other related outlet. The multivariate probit model assumes that each subject has distinct binary responses, and a matrix of covariates that can be any mixture of discrete and continuous variables. Generally speaking, the multivariate probit model assumes that given a set of explanatory variables the multivariate response is an indicator of the event that some unobserved latent variable falls within a certain interval. The multivariate probit is an extension of the probit model (Greene, 2003) and is used to estimate several correlated binary dependent variables jointly. The model is specified as follows:

$$Y_{im} = \beta_m x_{im} + \varepsilon_{im} \dots\dots\dots (9)$$

Where Y_{im}^* ($m = 1 \dots k$) represent the unobserved latent variable of market outlets chosen by the i^{th} farmer ($i=1 \dots n$). Therefore, in this case $k =$ wholesaler, collector, retailer and consumer outlets, X_{im} is a $1 \times k$ vector of observed variables that affect the market outlets choice, β_m is a $k \times 1$ vector of unknown parameters to be estimated, ε_{im} , $m = 1, \dots, M$ are the error terms distributed as multivariate normal, each with a mean of zero, and variance-covariance matrix V , where V has values of 1 on the leading diagonal and correlations (Cappellari and Jenkins, 2003). Equation (9) is a system of m equations that as shown in Equation 10 below;

$$Y_1^* = x_1 \beta_1 + \varepsilon_1 \quad Y_1 = 1 \text{ if } Y_1^* \text{ is } > 0, Y_1 = 0 \text{ otherwise}$$

$$\begin{aligned}
Y_2^* &= x_2\beta_2 + \varepsilon_2 \quad Y_2 = 1 \text{ if } Y_2^* \text{ is } > 0, Y_2 = 0 \text{ otherwise} \\
Y_3^* &= x_3\beta_3 + \varepsilon_3 \quad Y_3 = 1 \text{ if } Y_3^* \text{ is } > 0, Y_3 = 0 \text{ otherwise} \\
Y_4^* &= x_4\beta_4 + \varepsilon_4 \quad Y_4 = 1 \text{ if } Y_4^* \text{ is } > 0, Y_4 = 0 \text{ otherwise.} \dots\dots\dots (10)
\end{aligned}$$

This system of equations is jointly estimated using maximum likelihood method. There are six joint probabilities corresponding to the six possible combinations of preferring and not preferring each of the four market outlets. The probability that all four market outlets have been preferred by household ‘i’ is given as:

$$\begin{aligned}
&\Pr(y_{1i} = 1, y_{2i} = 1, y_{3i} = 1, y_{4i} = 1) = \\
&\Pr(\varepsilon_{1i} \leq \beta_1 x_{1i}, \varepsilon_{2i} \leq \beta_2 x_{2i}, \varepsilon_{3i} \leq \beta_3 x_{3i}, \varepsilon_{4i} \leq \beta_4 x_{4i}) = \Pr(\varepsilon_{4i} \leq \beta_4 x_{4i} / \varepsilon_{3i} \leq \beta_3 x_{3i} / \varepsilon_{2i} \leq \\
&\beta_2 x_{2i}, \varepsilon_{1i} \leq \beta_1 x_{1i} \times \Pr(\varepsilon_{3i} \leq \beta_3 x_{3i} / \varepsilon_{2i} < \beta_2 x_{2i} / \varepsilon_{1i} < \beta_1 x_{1i} \times \Pr(\varepsilon_{1i} \leq \beta_1 x_{1i}) \dots\dots\dots (11)
\end{aligned}$$

3.5. Hypothesis and Definition of Variables

The following are major explanatory variables which have been hypothesized as they have a significant influence over smallholder farmer’s participation intensity in mango marketing and market outlet choice in the study area. The tentative assumption was either accepted or rejected depending on the final finding of the study.

Dependent variables

Intensity of market participation (PARTINTE): Is continuous dependent variable that can be measured by the degree of participation of farmers in mango market in terms of quantity of mango supplied to the market in quintal.

Market outlet choice (MKTOUTCHO): Is the set of an unordered binary dependent variables and measured by the probability of selling mango to either of the given market outlets. The outlet choices might be along farmers decision involving in the number of alternative market outlets available in the area. It is represented in the model as Y_1 for

households who either sell mango to wholesalers or not, Y_2 for producers who either sell mango to collectors or not, Y_3 for producers who either sell mango to retailers or not and Y_4 for producers who either sell mango to consumers or not.

Independent variables

Age (AGE): Is a continuous variable which is counted in number of years. Younger farmers are expected to be progressive, more receptive to new ideas and to better understand the benefits of agricultural commercialization. Younger farmers also have higher levels of education and contact with the outside environment. In most cases, older farmers view farming as a way of life rather than as a business and have a strong emotional or almost biological connection with farming and land. The older households tend to have more dependants causing more consumption, hence lowering marketable surplus (Ehui *et al.*, 2009). When age of the farmer is increasing, the physical effort to walk a long distance for the search of better marketing outlet and bargaining ability is declining. It is also true that farmer's ability to produce as per the requirement of a given level of marketing outlet decline as age is increasing. Bongiwe and Masuku (2012) found that age of the farmer was significant determinant of the choice to use non-wholesale market channel over other-wholesale market channel. Therefore, age was hypothesized to affect intensity of market participation and market outlet choice negatively and positively/negatively, respectively.

Sex (SEX): Is a dummy variable which takes the value 1 if male and 0 otherwise. Male headed households have a good tendency to participate intensively in market because male headed households have a good potential of crop production efficiency advantages over female headed households and expected to involve in market. Female headed household are expected to have a negative impact on intensity of market participation because they have limited resource endowment than their counterpart male. Cunningham *et al.* (2008) argued that men are likely to sell more due to their acumen in bargaining, negotiating and enforcing contracts. Sex affects choice of market outlet in that males have the tendency of selling their produce to the wholesale market outlet in comparison to their female counter parts. Makhura *et al.* (2001) reported that gender affects market channel participation for maize in the Northern Province of South Africa since most males use direct channel as they prefer instant

cash for leisure. Therefore, sex is hypothesized to affect intensity of market participation and market outlet choice of mango producers in the study area positively and positively/negatively, respectively.

Family size (FMSZ): Is a continuous variable which is counted in number of family members for the given household. Increase in household size increases domestic consumption requirements and may render households more risk averse. The household size explains the family labor supply for production and household consumption levels (Alene *et al.*, 2008). Positive sign imply that a larger household provides cheaper labor and produce more output in absolute terms such that the proportion sold remains higher than the proportion consumed. A negative sign on the other hand means that a larger household is likely to consume more output, leaving smaller and decreasing proportion for sale. It is hypothesized that households with more dependants are likely to have a lower level of market participation. Large family size has a plenty of labor force to deliver mango to the market outlet which maximizes the benefits of farmers by paying good price. Tewodros (2014) indicted that family size positively determined the choice of wholesale market outlet of the chickpea producers. Therefore, family size is hypothesized to affect intensity of participation and choice of market outlet positively and positively/negatively, respectively.

Education (EDUC): Is a dummy variable which takes the value 1 if the farmer is literate and 0 otherwise. Education has a positive effect on intensity of market participation because it enhances the skill and ability to utilize better on market information, which may in turn reduces marketing costs and make it more profitable to participate in the market by augmenting marketable surplus. High education level is important, as it is likely to lead to the reduction of search, screening and information costs. Human capital, represented by the household head's formal education is posited to increase a household's understanding of market dynamics and therefore improve decisions about the amount of output sold, inter alia (Makhura *et al.*, 2001). Educated farmers know the market channel which reduces their transaction cost and they have a good bargaining ability. Hobbs (1997) found that education influences farmers channel choice in livestock marketing. The expected outcome of education over intensity of market participation and market outlet choice is positive and positive/negative, respectively.

Distance to market (DISNEAMKT): It is the distance of the mango producer households from the nearest market and continuous variable which is measured in kilometer/minutes of walking time. The closer the market, the lesser would be the transportation charges, reduced walking time, and reduced other marketing costs, better access to market information and facilities and a high supply of goods to the market. Anthony *et al.* (2012) has indicated that probability of participating in fish marketing was significantly affected by distance to the nearest marketing channel of the fish farmer/marketer. Also those households who are close to market were assumed to have more probability to choose better market outlet. In an early study on infrastructure and market access in Madagascar, Minot (1999) showed that the choice of marketing outlet among trader is negatively related to the distance to the market site. The expected outcome of distance to market over intensity of market participation and market outlet choice is negative.

Quantity of mango produced (QUANMAPRO): Is the continuous independent variable which will be measured in quintal. Production of the large volume of mango may motivate an individual to supply more to the market. Surplus production of mango has positive correlation with the intensity of market participation. Quantity of mango produced also determines the choice of market outlet. A large quantity of mango produced initiates farmers to sell to traders who purchase in bulk and vice versa. Geoffrey *et al.* (2014) indicated that large production scale positively influences the farmer to sell their produce at market place mainly because of economies of scale which lower transaction cost. The expected outcome of quantity of mango produced over intensity of market participation and outlet choice is positive and positive/negative, respectively.

Membership in group (MEMBER): Is the dummy variable which takes the value 1 if the household is member of certain group and 0 otherwise. Membership in group enables farmers to deliver mango to the better market outlet by pooling resources. Therefore, membership in group is hypothesized to affect market outlet choice of mango producers either positively or negatively in the study area.

Price of mango (PRICE): Is a continuous independent variable which is measured by the amount of price paid per a given unit kilogram. Paying a good price motivates farmers to

supply more of their products to the market. In this case price serves as a signal which attracts farmers to participate to earn good income from sell of their farm produce. Alene *et al.* (2008) argue that output price is an incentive for sellers to supply more to the market. Price is an important driver of market entry for the small ruminant livestock keepers in Kenya (Jamin *et al.*, 2012). The expected outcome of price factor is positive over intensity of market participation. Farmers supply their produce to the market outlet which pays a good price. Staal *et al.* (2006) found that price offered per liter of milk market channel, the more a household prefers that outlet for accessing and selling milk. Price is hypothesized to affect choice of market outlets of mango producers either positively/negatively, respectively.

Post harvest loss (POSTHALO): Is the continuous variable which is measured by the amount of mango goes to loss in quintal. Because of the perishability of mango, post harvest loss during harvesting and storage reduces the amount of mango that might be supplied to the market. In this case post harvest loss of mango weakens the intensive participation of farmers in mango market. The expected outcome of post harvest loss over intensity of market participation is negative.

Access to credit (ACCCRE): Is the dummy independent variable which takes the value 1 if there is access to credit and 0 otherwise. Access to credit is important to engage in improved production system which in further contributes to the intensive involvement of farmers in market. Acquisition of credit promotes production and selling of small ruminants in the market (Jamin *et al.*, 2012). Access to credit enables to produce a given commodity based on the given standard and quality level of particular outlet. It also enables farmers to search for better marketing outlet thereby boosting their financial capacity. Unquiet (2009) found that access to loan was significant determinant of market channel choice. The expected outcome of access to credit over intensity of market participation and outlet choice is positive and positive/negative, respectively.

Access to extension service (ACCEXSER): Is dummy independent variable which will take the value 1 if there is access to extension service and 0 otherwise. Extension service is expected to impact positively on intensity of market participation because it is through extension services that farmers are able to acquire better skill and knowledge on production

and marketing. Farmer's access to extension service increases the ability of farmers to acquire important market information as well as other related agricultural information which in turn increases farmer's ability to choose the best market outlets for its product. Mamo and Degnet (2012) found that agricultural extension services in the form of visit of farmers by extension officers tended to increase the probability of selling directly to consumers in livestock market channel choice of farmers in Ethiopia. The expected outcome of access to extension service over intensity of market participation and market outlet choice is positive and positive/negative, respectively.

Access to market information (ACMKTINFO): Is dummy variable which take the value 1 if there is access to market information and 0 otherwise. Poor access to market information result in information-related problem, namely moral hazard and adverse selection which in turn increase transaction costs, leads to decline in quantity of supply and hence discourages intensity of participation in the market by some farmers (Fatchamp and Hill, 2005; Shiferaw *et al.*, 2009). Jari (2009) stated that availability of market information boosts confidence of household who are willing to participate in the market. The expected outcome of access to market information over market participation intensity is positive. Access to market information determines market outlet choice of farmers by informing a market channel which pays better price. This means price information related with the particular market outlet determines the choice of market outlet which maximizes farmers' utility. Geoffrey *et al.* (2014) indicated that access to price information determined the choice of pineapple market outlet choice in Kenya. Therefore, access to market information was expected to affect the market outlet choice of the farmers either positively/negatively.

Access to non-farm income (ACNONFAIN): Is dummy variable which take the value 1 if the households have access to non-farm income and 0 otherwise. Access to non-farm income may lead to risk reduction in household decision making and, with it, increased propensity to undertake higher risk activities, notably selling crops or producing for the market. Rehima (2006) who found that if pepper producer have non-farm income, the amount of pepper supplied to the market decreases. Again, farmers who have access to non-farm activities have a better knowledge on marketing and market outlet which maximize their revenue. Hence,

non-farm income was hypothesized to influence intensity of market participation negatively and outlet choice decision of mango producers either positively/negatively.

Income from sale of other crops (INCOTHE SALE): Is continuous variable which is measured by the amount of income obtained from sell of other crops in birr. Obtaining better income from other enterprise motivates farmer to consolidate that enterprise and makes farmer pay attention on it. In this case, the amount of mango supplied to the market may decline which in further contributes to the low level participation of farmers in mango market. The expected outcome of income from sell of other crops over intensity of participation in mango market is negative.

Owning transportation means (OWNTRAME): Is a dummy variable which takes the value 1 if the household owns transportation means and 0 otherwise. Households with own transport means are likely to transport more of their agricultural product on time to the market before losing value. Ownership of transport equipment such as bicycles, motorcycles and truck have a positive impact on market participation by reducing the cost of transporting output from the farm to the market (Key *et al.*, 2000). Availability of transportation facilities help to reduce long market distance constraint, offering greater depth in marketing choices (Abraham, 2013). The same study indicated that farmers who have transport facility could supply their product to local market center and sell to wholesalers or retailers directly by getting better price which might go to the collectors. The expected outcome of ownership of transportation means over intensity of market participation and outlet choice is positive.

Access to market (ACCMKT): Is the dummy variable which takes the value 1 if accessible and 0 otherwise. If there is access to market, the farmer's intensity of market participation increases. This means that a market with potential demand for mango produce initiates farmers to increase supply of their product to the market which in further contributes to the strong involvement of farmers in market. Therefore, access to market is hypothesized to affect the intensity of participation and market outlet choice of mango producers in the study area.

4. RESULTS AND DISCUSSION

This part of the thesis deals with the final findings of the study which have been obtained through analytical approaches applied based on the nature of study. In general, overall detail of socio-economic, demographic, institutional characteristics, value chain analysis and econometric results obtained from the study area is discussed further.

4.1. Demographic and Socio-economic Characteristics of the Households

Analysis of demographic and socio-economic characteristics of the sample unit is quite important to infer their intimate relationship with agricultural marketing pattern of sample households in the study area. As indicated in Table 2, the mean age of sample households in the study area is around 43 years. Age of the household is related with the effort to produce and market a remarkable quantity of mango. The mean family size of sample households is 6.54 which is above the national average family size of Ethiopia (5.4). Family size affects market participation of smallholder farmers thereby contributing to an efficient production or by consuming a high proportion of the good produced.

Table 2: Demographic and socio-economic characteristics of the households for continuous variables

Variables	Mean	SD
Age in years	42.9	13.477
Family size in number	6.54	2.555
Distance to the nearest market in minute of walk	27.45	22.32
Mango production experience in years	16.97	6.084
Marketing experience in years	9.28	5.287
Income from sale of other crops in birr	2004.34	1406.456

*SD stands for standard deviation

Source: Survey result (2015)

The mean distance to the market is 27.45 minutes of walk from mango production point to the final sale. A long distance to market discourages the intensive participation of farmers as it needs a lot of time and effort to deliver final market. The mean mango production experience of farmers' in the study area is around 17 years. The mean mango marketing experience of sample households is 9.28 years. When farmers are getting more experienced in marketing, they have clear decision making ability either to participate or not participate intensively in marketing. The mean income obtained by sample households from sale of other crops is 2004.34 birr. When income from sale of other crops increases, farmers tend to invest their time and effort on that sector while putting low income sector aside.

As depicted in Table3, from the total of 138 sample households about 89% and 11% were male headed and female headed households, respectively. About 60% and 40% of sample households are illiterate and literate, respectively. This indicates that more than half of the sample households in the study area are illiterate. As indicated in the Table3, about 91.3%, 70.3%, 67.4%, and 65.9%, of sample households have access to market, market information, credit, and extension service, respectively. Correspondingly, about 34.1%, 32.6%, 29.7% and 8.7% of the sample households have no access to extension service, credit, market information, and market, respectively. About 85.5% and 14.5% of the sample households have membership in group and no membership in group, respectively. This is the organization in which farmers have been grouped for small scale mango processing launched by non-governmental organization rather than for group marketing of mango. This is to mean that there is no mango marketing cooperative in the study area.

The survey has further revealed that despite credit service is accessible for majority of the households in the study area; no farmer has used credit for mango production and marketing purpose. In addition to this, farmers obtain market information from traders, brokers, other farmers and by formally attending the market rather than from formal market information service. Small scale farmers' access to extension, credit and market information is quite prominent for the commercialization of rural economic sector. Therefore, allocation of institutional service should be strengthened and target all members of the rural community.

Table 3: Demographic and institutional characteristics of the households for dummy variables

Variables	Category	N	%
Sex	Female	15	11
	Male	123	89
Educational status	Illiterate	83	60
	Literate	55	40
Access to extension service	No	47	34.1
	Yes	91	65.9
Access to credit	No	45	32.6
	Yes	93	67.4
Access to market	No	12	8.7
	Yes	126	91.3
Access to market information	No	41	29.7
	Yes	97	70.3
Membership in group	No	118	85.5
	Yes	20	14.5

N = frequency, % = percentage

Source: Survey result (2015)

4.2. Livelihood and Farming System of the Households

Farming is the major livelihood system for the majority of the sample households in the study area as depicted in Table 4. About 73.2% of sample households use farming as the major means of sustaining life in the area and the remaining 24.6%, 1.4% and 0.7% use farming together with the trading, farming together with carpentering and farming together with the office working, respectively, as a means of livelihood.

Table 4: Livelihood of sample respondents

Livelihood system	N	%
Farming	101	73.2
Farming and trading	34	24.6
Farming and carpentering	2	1.4
Farming and office working	1	0.7
Total	138	100.0

N= frequency, %= percentage

Source: Survey result (2015)

As depicted in the Table5, farming system of the area is dominated by traditional crop-livestock production system. About 87% of sample respondents practice crop-livestock production system whereas the remaining 13% practice only crop production. Major plant crops grown in the area may include maize, teff, haricot bean, ginger, coffee and perennial crops such as mango, avocado, banana, papaya, orange and root crops such as enset, yam, sweet potato, and taro are the common crops cultivated in the area. The major livestock animals reared under mixed farming system of the area may include cattle, sheep, goat, equine, and poultry. Thus, mixed farming system is the major livelihood system of majority of the sample households in the study area.

Table 5: Farming system of sample households

Items	N	%
Crop-livestock production	120	87.0
Only crop	18	13.0
Total	138	100.0

N=frequency, % = percentage

Source: Survey result (2015)

4.2.1. Mango production system

Mango is one of perennial crop grow under lowland agro ecology with a minimum moisture requirement. Sole planting is the major mango production practice adopted in the study area. Majority of sample respondents in the area practice sole planting of mango because of the competition for nutrient and they believe that mango suppresses the growth performance of other crop. During the early stage of maturity, farmers intercrop mango with other perennial crops and coffee at home garden for seedling purpose. Then, seedling of mango is transported from backyard garden to the outside in order to minimize nutrient competition and to provide canopy during sunny season as mango tolerates dry weather. This is in agreement with the Vanmelle and Buschmann (2013) who found that production of mango is less vulnerable to drought than other crops in selected areas of Benin, Ghana, and Burkinafaso.

During planting seedling were planted sparsely, without giving consideration for spacing of orchards despite orchards spacing is important for productivity of mango tree. Seedling of mango taken off from backyard garden to the outside is fenced in order to protect from the tame animals. This is in agreement with the Ian (2006) who reported that it is necessary to fence off mango young trees for the first 3–4 years to protect them from livestock.

The survey result has further revealed that about 65.2%, 15.5%, 11.6% and 6.5% of sample respondents practice sole planting, intercropping, sole planting and intercropping, respectively, as shown in the Table 6. Intercropping of mango with maize, coffee, yam and taro in backyard at early stage is also a usual practice in study area. This is in agreement with Ayelech (2011) who found that farmers intercrop mango with maize, taro, ginger, chat, cabbage and banana at early stage in Goma woreda, Oromia regional state.

Table 6: Mango production systems in the study area

Items	N	%
Sole planting	90	65.2
Sole planting and intercropping	25	18.1
Intercropping	23	16.6
Total	138	100

N = frequency, % = percentage

Source: Survey result (2015)

4.2.2. Purpose of mango production

Small scale farmers in the study area produce mango for variety of purpose such as for sale, consumption and canopy or combination of all. About 86.2%, 71.7% and 65.2% of sample respondents produce mango for a variety of purposes such as sale, consumption and canopy , respectively.

Table 7: Purpose of mango production in the study area

Particulars	N	%
Sale	119	86.2
Consumption	99	71.7
Canopy	90	65.2
Total	138	100.0

N = frequency, % = percent

Source: Survey result (2015)

This finding is in line with Akinnifesi *et al.* (2008) who indicated that the dozens of indigenous fruit tree species although relatively unknown in global markets, are locally of large importance for food/nutrition security and income generation. Also Ian (2006) reported that canopy of mango is evergreen with a generally spreading habit and heavy canopy of the mango is a source of shelter and shade for both animals and humans.

4.2.3. Contribution of mango to the household income

Mango is one of the fourth most important crops for the livelihood of the households in the study area there by contributing to the income of the households as indicated in Figure3. The survey has indicated that mango contributes about 7% of the annual income obtained from sale of crops and livestock at household level.

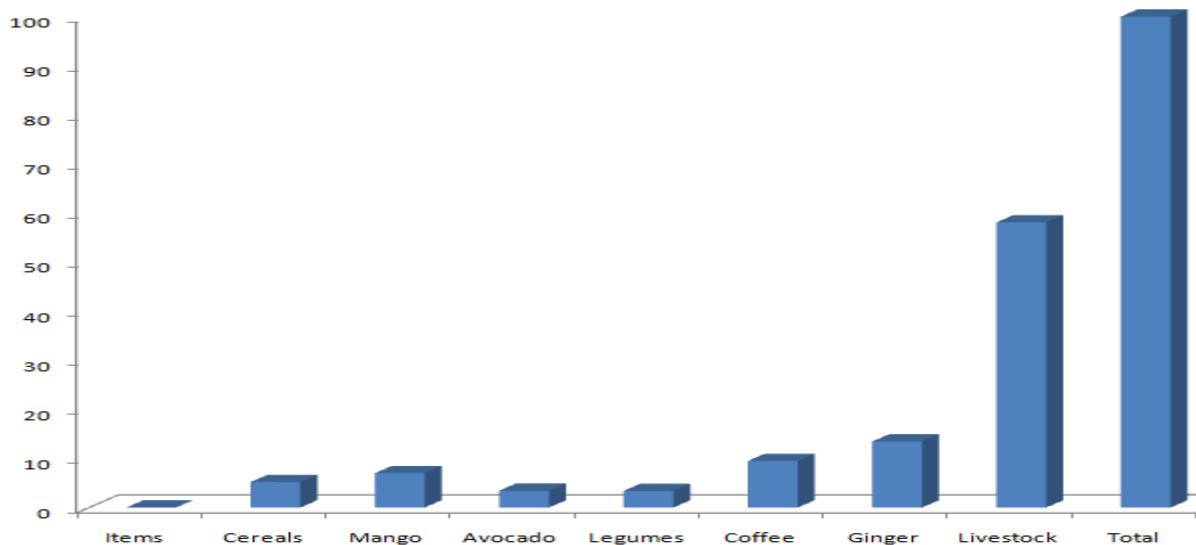


Figure 3: Contribution of mango to households' income in comparison to other crops

Source: Survey result (2015)

4.2.4. Inputs used for mango production

Majority of sample mango producers use local mango variety for their production. Some portion of sample households used improved mango variety together with the local variety. As shown in Table 8, about 81.2% and 18.8% of sample households use local variety and local variety with the improved variety, respectively. The survey has further revealed that no mango producer use only improved variety for production. Among the improved mango variety apple mango is available for a limited number of mango producers in the study area. Framers in the study area use different types of inputs for mango production. The main types of inputs used for mango production in the study area may include family labor, compost/farmyard manure, seed/seedling and rain water during summer season.

Table 8: Mango varieties used by households in study area

What kind of mango variety do you use?	N	%
Local variety only	112	81.2
Local and improved variety	26	18.8
Total	138	100

Source: Survey result (2015)

As depicted in Table 9, about 30.4%, 27.5%, and 20.2% of sample households in the study area use compost/farmyard manure, water, a combination of compost/farmyard manure and water, respectively as input for mango production. The survey has further revealed that about 21.7% of sample households did not use any input for mango production because they assume that mango do not need any input after it has reached at maturity stage. Application of compost/farmyard manure in circular form around the stem of mango tree during the sunny season is the common practice in the study area. During the rainy season farmers divert the rain water by digging in circular form around the mango tree which capable it to reduce transpiration and keep it evergreen during sunny season. The survey has further indicated that none of the mango producer in the area used inorganic fertilizer for mango production.

This finding is in agreement with the Ayelech (2011) who indicated that FYM principally transported from homestead to the field mostly during the dry season and spread in the bottom of each tree in circular form and chemical inputs entirely evaded neither for fertilization nor for pest treatment.

Table 9: Inputs used for mango production in study area

Inputs	N	%
None	30	21.7
Compost/farmyard manure	42	30.4
Rain water	38	27.5
Compost/farmyard manure and water	28	20.2
Total	138	100

N = frequency, % = percentage

Source: Survey result (2015)

4.2.5. Input supply

Farmers acquire mango varieties from other farmers, own stocks, from market and extension centre as indicated in Figure 4. Mango varieties acquired from other farmers and market is the local one whereas mango variety acquired from extension centre is the improved variety like apple mango. Farmers in the study area obtain mango seedling from the market through buying from other farmers or find mango seed from the market. The survey revealed that all famers in the study area acquire inputs used for mango production like compost/farmyard manure and garbage from their own stock. As indicated in the figure 4, majority of households acquire mango seed from other farmers and insignificant number of households acquire mango from extension centre and market. Therefore, strengthening of agricultural extension service in dissemination of improved mango variety is quite important.

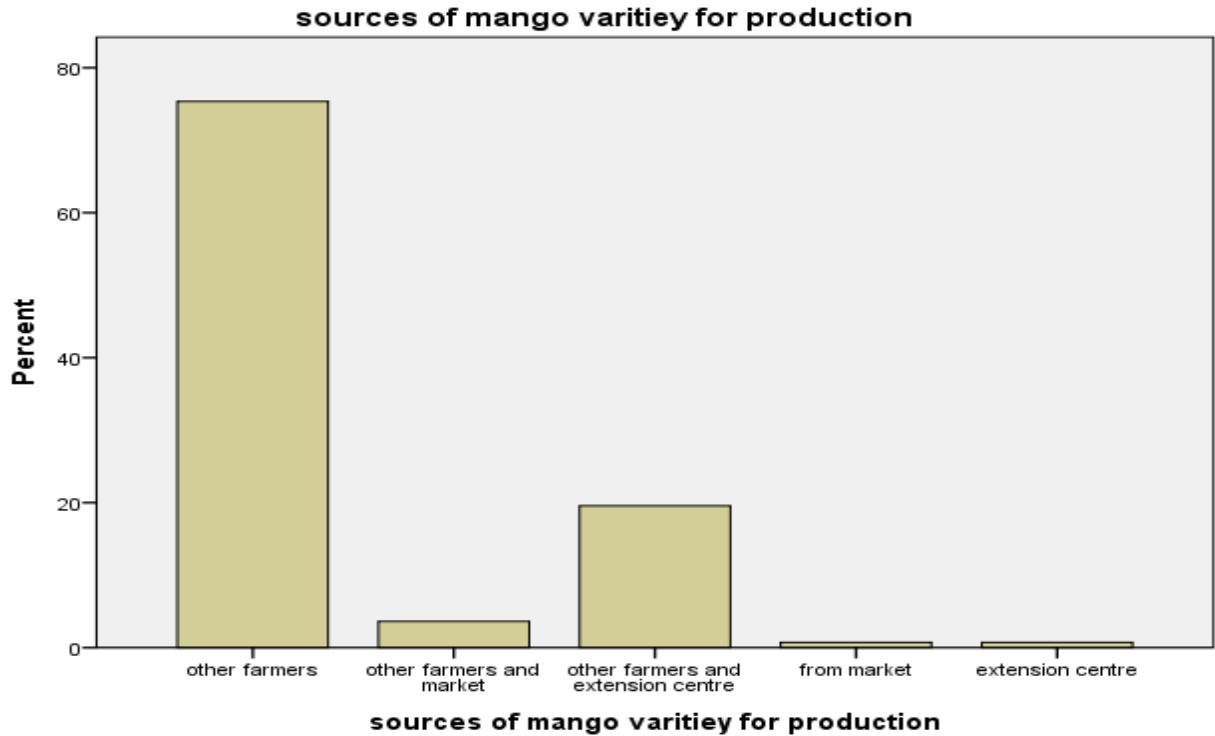


Figure 4: Sources of mango varieties in study area

Source: Survey result (2015)

Harvesting of mango

Harvesting of mango in the study area begin after the mango fruit show a maturity index. The peak period of harvesting mango in the study area is December-February (first phase) and march-may (second phase). The mean frequency of harvesting mango is at least 3 times in a year. The basic maturity index for harvesting of mango in the area is the formation of colour change on the surface of mango fruit. Another maturity index for harvesting of mango is the downfall of mango fruit form the tree on the surface of the earth. This is in line with Ayelech (2011) who found that harvesting usually starting after fruit dropping-which is principal maturity index. Harvesting fully ripen, partially ripen and unripe mango is the common stages of harvesting mango in the study area as shown in the Table 10. The survey has indicated that about 87.7%, 35% and 45.6% of households harvest ripe, partially ripe and unripe mango, respectively.

Table 10: Harvesting stages of mango in the study area

Harvesting stages	N	%
Harvest ripe mango	121	87.7
Harvest partially ripe mango	48	35
Harvest unripe mango	63	45.6
Total	138	100

N = frequency, % = percentage

Source: Survey result (2015)

Harvesting methods adopted in the area may include hand picking, using stick, cutting by scissor and children climb on mango tree with bag. Hand picking and using stick are the most common practices of harvesting mango in the study area as indicated in Table11. Hand picking is applicable when mango fruit is near to the surface of the ground and this method is so safe to protect mango fruit from mechanical damage and bruising. Using of stick is mainly to harvest mango which is far above the ground and not harvestable by hand.

As alternative to stick picking, children climb on mango tree with box to harvest mango which is far from surface of the ground and cannot picked by hand. This is to mean that children climb on tree with wood box and hang the box on tree branch. This is mainly to protect mango from serious mechanical damage which occurs while using stick method. Cutting by scissor is also practiced to harvest mango in the study area but at lower rate as depicted in Table11. Hand picking method of harvesting produce can maintain good quality of fruit and protect the fruit from mechanical damage. The proportion in the Table11 indicates that sample households can use more than one harvesting method in the study area. This finding is in line with (Seid and Zeru, 2013) who found that hand picking can produce the fruit with stem and reduce fruit bruising and damage but stick structure result in fruit dropping and leave the fruit without stem which facilitate fruit bruise and mechanical damage.

Table 11: Harvesting methods of mango in the study area

Harvesting Methods	N	%
Cut by scissor	3	2.2
Using sticks	135	97.8
Hand picking	125	90.6
Children climb on tree with bag	18	13
Total	138	100

N= frequency, % = percentage

Source: Survey result (2015)

4.3. Market Participation of the Households

From the total households of the survey, about 87% and 13% of the sample mango producers were participants and non-participants in mango marketing, respectively. The participation of households in mango market is subject to the interactive effect of demographic, socio-economic, institutional and market factors. To examine the critical factors causing variation among market participants and non-participants, both t-test and chi-square test have been used for continuous and dummy variables, respectively as shown in Table12 and Table13. By computing the t-statistic, a p-value can be determined, displaying the extent of difference of the means between two populations where the smaller the p-value, the more significant is the difference between the distributions of the two populations (McDonald, 2008).

Accordingly, the mean age of non-participants and participants in mango market is 43.11 and 42.87 years, respectively. The mean age of non-participants (43.11) is greater than that of participants (42.87 years). This implies that market participation decreases when age is increasing. But, statistical insignificance of mean age of the households indicates the age distribution of the households is almost similar. The mean production experience of non-

participants and participants is 13.33 and 17.52 year, respectively, which is statistically significant at 1% level of significance. The mean production experience of mango market participants (17.52 year) is greater than that of non-participant (13.33 years). This implies that when farmers are getting more experienced in farming, their level of understanding on benefit of participating in mango market is increasing. The mean family size of non-participants and participants in mango market is 6.22 and 6.28 members, respectively. Statistical insignificance of the variable indicates that family size of participant and non-participant households is almost equal and explanatory power of the variable cannot be measured. Similarly, the mean distance to the nearest market is also insignificant indicating that distance to the market is almost similar for both categories.

The mean quantity of mango produced by households is statistically significant at 1% level of significance which is 1.8 quintal and 8.56 quintal for non-participants and participants, respectively. The mean quantity of mango produced by market participants (8.56 quintal) is greater than the mean quantity of mango produced by non-participants (1.8 quintal). This indicates that surplus production promotes market participation of farmers by increasing marketable amount. This is in line with the Omit *et al.* (2009) who found that the total quantity of output produced per season determines the market participation of farmers. The mean quantity of mango goes to postharvest loss is 1.58 and 1.27 quintal for non-participants and participants in mango market, respectively which is statistically significant at 5% level of significance. Increase in post harvest loss decreases the amount of mango available for market supply and hinders participation in market. Therefore, enhancing productivity and reducing post harvest loss is essential to enhance the market participation of small scale farmers and improvement of rural livelihood.

The mean income from sale of other crops is 3783.33 and 1737.5 birr for non-participants and participants in mango marketing, respectively. The mean income obtained from selling of other crops of non-participants (3783.33 birr) is greater than that of participants in mango market (1737.5 birr) which is significant at 1%. This indicates that better income obtained from selling of other crops like ginger discourages farmers' participation in mango market and creates a substitution effect over mango sector.

Table 12: Statistical test of continuous variables across market participation

Variables	Market participation category				t-value
	Non-participants		Participants		
	Mean	SD	Mean	SD	
Age (year)	43.11	15.35	42.87	13.25	0.03
Family size (number)	6.22	2.29	6.28	2.6	0.606
Distance to the market (minute of walk)	16.50	14.74	15.6	11.54	0.632
Production experience (years)	13.33	5.13	17.52	6.05	2.763***
Quantity of mango produced (quintal)	1.8	1.00	8.56	7.72	3.729***
Post harvest loss in quintal	1.58	0.45	1.27	0.55	2.121**
Income from sale of other crops (birr)	3783.33	1412.44	1746.5	1200.63	6.547***

Note: SD stands for standard deviation, *** and ** are statistically significant at 1% and 5%, respectively

Source: Survey result (2015)

Chi-Square tests are statistical tests that are commonly used to determine whether there are significant differences between expected frequencies and the observed frequencies in one or more categories (Sirkin, 2006). The chi-square test of dummy variables indicated that there were statistically significant difference between participants and non-participants in terms of educational status, access to extension service, access to credit, access to market, and owning transportation means. Accordingly, variables such as sex, access to market information and access to non-farm income are not significant indicating that there is no significant difference in frequencies of the variables across market participation. As depicted in Table13, educational status of households is found to be significant at 1% level of significance. Households attended formal schooling have participated more in mango market than households did not attend formal schooling as shown in Table13. This implies that being educated increases the probability of involving in mango market by fostering their ability of obtaining new ideas and innovations related with the market. This is in line with Heierli and

Gass (2001) who indicated that level of education gives an indication of the household ability to process information and makes to have better access to understanding and interpretation of information than others.

There was significant difference between participants and non-participants in terms of access to extension at 1% probability level. Farmers who have access to extension service have participated more in mango market (71.7%) than that of farmers who do not have access to extension service (28.3%). This implies that extension service provision on better production and productivity of mango leads to the market participation of farmers. Similarly, there was significant difference between market participants and non-participants in terms if access to credit. It was found that market participants have more access to credit than non-participants. The proportion of farmers who have access to credit that have participated in mango (75%) is greater than that of farmers who participate in mango market without access to credit (25%). This implies that credit access enables farmers to purchase improved mango varieties and breeding of mango as well as owning of transportation means which improve their production and marketing system and eventually leads to farmers' participation in formal market.

There was significant difference between market participants and non-participants interms of access to market at 1% probability level. The proportion of households who participate in mango marketing with access to market (96.7%) is greater than that of farmers who participate without access to market (3.3%). This implies that a market with potential demand for mango initiates farmers to sell their mango.

Table 13: Statistical test of dummy variables across market participation

Variables		Market participation category		χ^2 -test
		Non-participants (%)	Participants (%)	
Sex	Female headed	43	57	1.954
	Male headed	48	52	
Educational status	Illiterate	100	45.8	20.04***
	Literate	0	54.2	
Access to extension service	No	72.7	28.3	13.785***
	Yes	27.3	71.7	
Access to credit	No	83.3	25	24.523***
	Yes	16.7	75	
Access to market	No	44.6	3.3	33.334***
	Yes	55.4	96.7	
Owning transportation means	No	88.9	59.2	7.45**
	Yes	11.1	40.8	
Access to market information	No	44.4	27.5	2.517
	Yes	55.6	72.5	
Access to non farm income	No	66.6	75	0.891
	Yes	33.4	25	

*** and ** is statistically significant at 1% and 5% level of significance, respectively

Source: Survey result (2015)

Owning transportation means has shown significant difference between market participants and non-participants at 5% probability level. The proportion of households who did not participate in mango market is 88.9% and 11.1% for households who own transport means and who do not, respectively. This indicates that the proportion of households who did not

participate in mango market due to lack of transport means is greater than that of households who participate in mango market with own transport means. This implies that owning transportation means enables farmers to efficient involvement in market thereby contributing to the reduction in marketing costs.

4.4. Quantity of Mango Produced and Marketed at Household Level

Table14 shows the mean quantity of mango produced, amount of mango goes to post harvest loss, consumed and marketed at household level in the study area. The mean quantity of mango produced at the household level is 7.7 quintal where as the mean quantity of mango supplied to the market is 5.2 quintal. The mean quantity of mango goes to post harvest loss and consumed at household level is 1.31 and 1.2 quintal, respectively. This implies that the deviation between amount of mango produced and marketed at household level is subject to the post harvest loss and consumption at household level irrespective of demographic and socio-economic variables.

Table 14: Amount of mango produced and marketed at household level in quintal

Particulars	Mean	Standard deviation
Quantity of mango produced	7.7	7.56
Quantity of mango goes to post harvest loss	1.3	5.44
Quantity of mango consumed at home	1.2	5.23
Quantity of mango supplied to the market	5.2	5.54
Total	7.7	7.43

Source: Survey result (2015)

4.5. Market Outlet Choices of the Households

Market outlet choices available for sale of mango in the study area include wholesaler, collector, retailer and consumer outlets. As indicated in the Table15, about 89.1%, 76.8%, 76%, and 74.6% of sample households sell their mango via wholesaler, consumer collector, and retailer outlets, respectively. Conversely, about 25.4%, 24%, 23.2% and 10.9% of sample households do not sell their mango via the retailer, collector, consumer and wholesaler market outlet, respectively. The survey has further indicated that no farmer has used cooperative as a market outlet in the study area except those who have been organized in mango processing unit.

Table 15: Proportion of market outlet choice of the households

Market outlets	Category	Frequency (n)	Percentage (%)
Wholesaler	Yes	107	89.1
	No	13	10.9
Collector	Yes	91	76
	No	29	24
Retailer	Yes	90	74.6
	No	30	25.4
Consumer	Yes	92	76.8
	No	28	23.2

Source: Survey result (2015)

4.5.1. Households' characteristics by market outlet choices

The effect of continuous variables over market outlet choice is examined by using mean comparison as Berhanu *et al.* (2013) and Geoffrey *et al.* (2014) have used. As shown in the Table 16, the mean age of sample households who sale mango to the retailer, consumer, collector and wholesaler, market outlet is 44, 43.34, 43.3 and 42.8, years old, respectively. This indicates that households who sale mango to the wholesalers are younger than

households who sale to other market outlets. And conversely, households who do not sale mango to the wholesalers are older than households who not sale to other market outlets.

Table 16: Mean household characteristic by market outlet choices

Variables	Category	Market outlet choices			
		Wholesaler	Collector	Retailer	Consumer
Age in year	Yes	42.80	43.29	43.88	43.34
	No	43.67	41.67	40.00	41.44
Family size in number	Yes	7.53	6.38	6.59	6.53
	No	6.39	6.94	6.29	6.47
Distance to the market in minutes of walk	Yes	29.15	30.1	25.72	24.65
	No	14.87	19.64	33.14	27.81
Quantity of mango produced in quintal	Yes	9.45	6.89	6.3	4.8
	No	5.83	6.93	12.1	9.9
Price in birr	Yes	3.2	2.01	2.18	2.5
	No	2.22	2.77	3.24	1.8

Source: Survey result (2015)

The mean family size of sample households who sale mango to the wholesaler, retailer, consumer and collector market outlet is 7.53, 6.59, 6.53 and 6.38, respectively. Accordingly, households who sale and do not sale mango to the collectors have smaller and larger mean family size, respectively in comparison to households who sale and do not to other outlets. This indicates that inadequacy of labor at household level obliges to sale mango at farm gate and labor endowment promotes involvement in formal marketing. The mean distance to the nearest market for households who sale their mango to the collectors (30.1 minutes walk) is greater than those who sale to another market outlets. This indicates that when distance to market is large, farmers prefer to sale their mango at farm gate. The mean quantity of mango produced for households who sale to wholesaler (9.45 quintal) is greater than households who sale to other market outlets. This implies that households who produce more prefer wholesale market since wholesalers purchase bulk quantity of mango. The mean price paid

for a unit kg of mango in birr is lowest for households who sale mango to the collectors in comparison to the households who sale to other outlets. This is due to the fact that farmers sale immature mango to the collectors at farm gate with a minimum price. This is in line with Montshwe (2006) stated that the farm gate sale tends to reduce farmers' revenue since the prices are relatively low.

4.5.2. Socio-economic characteristics of households by market outlet

The effect of dummy variables over market outlet choice is examined by the frequency of households selling to each market outlets as Berhanu *et al.* (2013) and Geoffrey *et al.* (2014) have used. Proportion of household characteristics by mango market outlets is given in Table 17. About 53.9%, 42.9%, 33.3%, and 30.4% of the male headed households used wholesaler, consumer, collector, retailer, and market outlet choices, respectively as a choice of marketing outlets. On the other hand, 69.6%, 66.7%, 57.1% and 46.1%, of the female headed households used retailer, collector, consumer and wholesaler, respectively as the choice of mango marketing outlets. This shows that the male headed households who used wholesale as the choice of marketing outlets were more than their counterparts. About 92.9%, 91%, 87% and 80.7% of households who have access to extension service used consumer, wholesaler, retailer and collector, respectively as market outlet choices. Households who have access to extension service have a minimum probability of selling mango to the collector market outlet. This is because extension service discourages selling of unripe mango as it increases postharvest loss and retards benefit derived from selling of it. About 87%, 84.3%, 72%, and 66.7% of households who have access to credit sell their mango to the retailer, wholesaler, consumer and collector, respectively as the market outlet. The proportion of households who have access to credit that sell mango to the collector market outlet (66.7%) is less than proportion of households who sell mango to the other market outlets. This indicates that access to credit enables farmers to endow economic resources in order to involve in formal marketing.

Table 17: Household characteristics by market outlet choices

Variables	Category	Proportion (%)			
		Wholesalers	Collectors	Retailers	Consumers
Sex	Female	46.1	66.7	69.6	57.1
	Male	53.9	33.3	30.4	42.9
Access to extension service	No	9	19.3	13	7.1
	Yes	91	80.7	87	92.9
Access to credit	No	15.7	33.3	13	28
	Yes	84.3	66.7	87	72
Access to market information	No	25.8	58.3	30.4	28.6
	Yes	74.2	41.7	69.6	71.4
Access to market	No	2.2	8.3	0	0
	Yes	97.8	91.7	100	100
Owning transportation means	No	80.9	91.7	87	57.1
	Yes	19.1	8.3	13	42.9
Membership in group	No	30.4	22.2	24.1	23.2
	Yes	46.2	11.5	26.9	15.4

Source: Survey result (2015)

About 74.2%, 71.4%, 69.6% and 41.7%, of households who have access to market information sell mango to the wholesalers, consumers, retailers and collectors, respectively as market outlet choice. This indicates that about 41.7% of households who have access to market information sell mango to the collector which is less than proportion of households selling to the other market outlets. This implies that when farmers are getting informed about opportunities in final market, their tendency of selling to collector at farm gate decreases. About 100%, 100%, 97.8%, and 91.7% of households who have access to market sell mango to retailer, consumer, wholesaler and collector, respectively, as market outlet choice. The proportion of households who have access to market that sell mango to the collector (91.7%)

is less than proportion of households selling to the other market outlets. About 42.9%, 19.1%, 13% and 8.3% of households who own transport means sell their mango to the consumer, wholesaler, retailer and collector, respectively, as market outlet choice as shown in the Table17. The proportion of households who own transport means that sell their mango to the consumer outlet (42.9%) is greater than proportion of households selling mango to other market outlets. This implies that owning transport means facilitate efficient delivery of mango to the terminal market thereby reducing cost of transaction.

About 46.2%, 26.9%, 15.4% and 11.5% of sample households who have membership in group sell mango to the wholesalers, retailers, consumers and collectors, respectively, as market outlet as indicated in Table17. The proportion of households who have membership in group that sell mango to the collector market outlet (11.5%) is less than the proportion of households selling to other market outlets. This implies that farmers who are member in group do not want to sell mango to the collectors at their village.

4.6. Results of Mango Value Chain Analysis

Value chain approach is mainly a descriptive tool to look at the interactions between different actors. Value chain analysis concerned with the contribution of value adding functions of each and every actor along the commodity chain. This is to mean that value chain analysis highlights the actors and their respective function/role along the commodity chain which in turn contributes to the addition of value in the chain for the satisfaction of the final user. It also helps to estimate the distribution of benefits among actors in the commodity chain.

4.6.1. Mango value chain actors and their functions

Value chain actors are agents playing their own role along a given commodity chain from the conception to final consumption. They may be direct and indirect actors who can take their part in each and every stages of the commodity chain. The direct actors are those who have product ownership and claim and engaged in transaction/transfer activities in order to gain economic benefit. Indirect actors are those who do not have product claim but, are aligned

along the chain for the efficiency of the actors thereby providing necessary services and supports. The primary/direct actors in mango value chain in Boloso Bombe Woreda were input suppliers, farmers, traders and consumers. Each of these actors adds value in the process of changing product title. Some functions or roles are performed by more than one actor, and some actors perform more than one role. The indirect actors along mango value chain in the study area are both governmental and non-governmental organizations which have been engaged in providing financial, legal, and marketing services. Among the governmental organizations Agricultural Extension Centre, Marketing and Cooperative Office and Ministry of Agriculture are the major ones which provide services along mango value chain in study area. Non-governmental organizations such as Japanese International Cooperation Agency (JICA/OVOP) and Omo Micro-Finance (OMF) institution are also playing their own role in mango value chain in the study area. The role of each actor along mango value chain in the study area is discussed further.

Input suppliers

These are actors which are engaged in supply and provision of raw materials for mango production in the area. The involvement of input suppliers in the mango sector of the study area is not intensive as much. The main reason for this is the low input demand for mango production and use of locally available inputs instead of the technological one. This result is in line with the James *et al.* (2008) who found that whilst the growing conditions are very well suited to growth of mangoes in Benishangul area, farmers are still mostly at a subsistence level with minimal use of production enhancement technologies or inputs. For this study, the major mango input supplier in the study area is the agricultural extension centre. Agricultural extension centre provides farmers with improved mango variety such as apple mango, harvesting equipment and technical advice on mango production. This institution brings improved mango variety from Arbaminch agricultural research centers and nursery sites and distributes to the farmers. But, the survey has further indicated that distribution of improved mango variety and harvesting equipment is not for all farmers because of the limited supply and provision of mango variety is mainly for comparative analysis of local mango variety against the improved one. In addition to this, there are no private input suppliers who have been engaged in agro seed and chemical enterprises in the

area. Therefore, it is necessary to improve mango sector of the study area by enhancing modernized way of production and marketing system.

Producers

These are small scale farmers who produce mango by using their own resources. They use either local or improved mango variety to produce and market to the forward actors involved along the mango value chain. From the production aspects, the main value chain functions performed by the small scale farmers are planting, tree management, pruning, transplanting and harvesting by using local planting materials such as mattock, zapa, and hummer. They use locally available inputs such as compost/farmyard manure and water for mango production so that they produce in organic manner. From the marketing point of view, they use their own manual labor such as human labor and cart to deliver their produce either to the local market such as Bombe and Adila town or other spatial markets such as Hadaro and Areka. They also sale mango at farm gate to mango traders like collectors and wholesalers. Table18 shows value adding functions performed by sample households and the result indicated that a given household can perform more than one value adding activities.

Table 18: Value adding activities performed by the mango producers

Activity	N	%
Grading	117	97.5
Sorting	117	97.5
Drying	41	34.2
Standardizing	48	40
Cleaning	80	66.7
Total	120	100.0

N= frequency, % = percentage

Source: Survey result (2015)

The main value adding activities performed by farmers prior to marketing is the post harvest handling activities such as grading and sorting, drying, cleaning, and standardizing. The primary aim of performing these activities is in order to deliver quality mango to the traders.

They use materials such as basket, mica, plastic bag, sack, cartoon and wooden box for packaging of mango during marketing.

Collectors

These are farmers/mango traders who invest their own capital for mango assembling and part time traders in assembly markets who collect mango from farmers in village markets for the purpose of reselling it to wholesalers. They use their financial resources and their local knowledge to bulk and collect mango from the surrounding area. They collect and assemble unripe mango in farm gate for 5-7 days and sell at the assembly point to the wholesalers coming from Guraghe, Siltie, and Wolaita. During at the assembly point they use dry grass either to ripe mango or to protect mango from being contacted with the surface of the earth as well as from fog. They play important role by informing and they do know areas of surplus well. The trading activities of collectors include buying and assembling, repacking, sorting and selling to wholesale markets. They often receive cash from wholesalers after or before sell. The survey has further indicated that all mango collectors in the study area were unlicensed and they begin collecting of mango prior to peak maturity period. Collecting of mango prior to peak maturity period eventually leads to decrease in farmers' utility because farmers were obliged to sell unripe mango with a low price after it has been harvested. Some concerned bodies and farmers who have awareness are complaining the action taken by collectors.

Wholesalers: These are known for purchase of bulky products with better financial and information capacity and they are licensed mango traders. They purchase mango directly from farmers/local collectors and indirectly through brokers. The survey has revealed that majority of wholesalers who receive mango from study area are coming from Guraghe and Siltie. They hire part time mango collectors to collect matured and partially ripe mango at village and this partially ripe mango is covered with the dry grass at village for 5-7 days. They are major actors in the mango value chain by transporting and distributing mango to the other mango traders in spatial markets such as Awassa, shashemene, Mekele, Desie, Bahirdar, Zeway, Adama and Addis Ababa. They sell mango to wholesalers in the regional markets who resell mango to the retailers, processors and consumers in terminal markets.

They also sell mango to the retailers outside the study area. They use Isuzu as major transport means to deliver mango to other markets. They procure and consign large amount of mango to the regional markets and to terminal markets. The critical role played by wholesalers along mango value chain in the area is hiring of a significant amount of human resource from collection point to the final sell mainly for quality control activities such as grading and sorting and loading.

Retailers: These are known for their limited capacity of purchasing and handling products with low financial and information capacity. They purchase mango from Bombe local market and sell to consumers and processors in Areka, Hadaro and Sodo town. Their product handling capacity is a maximum of 10 quintal of mango in a given market day. They mainly purchase mango from farmers who bring either ripe or unripe mango. They travel at least 26-55 km to deliver mango from the study area to the other nearby markets aforementioned. Mango retailers in the study area purchase either ripe or unripe mango. Use of Isuzu as a transport means in rental form is a common mechanism of delivering mango to other nearby markets. Some others use cart as means of transport to deliver mango to the other markets. Those who purchase ripe mango mainly to sell to the consumers and processors as well as shops immediately and those who purchase unripe mango resell to other retailers in Areka who in further take away to the Hossana and Kambata markets. They hire a small number of labors for quality control activities such as sorting and grading and loading and unloading. But the assessment has further indicated that, all mango retailers in the study area were not licensed to purchase mango.

Processors: These are private hotels, cafeteria and restaurants and farmers' mango processing saving and credit cooperative organized by the non-governmental organization named as One Village One Product Promotion Project (OVOP). Mango processing in the study area is apparently skewed to juice making where cafés, restaurants, hotels and juice houses take the leading position in juice preparation. There is one agro-processing unit (Firafire Limat Mango Processing Saving and Credit Cooperative) which has been organized by JICA/OVOP in collaboration with Ministry of Agriculture (MoA) that underpin on mango. But, after a few months the project will cease its endeavor of promoting mango.

Processors are known for their changing of fresh fully ripe mango into processed goods such as juice (hotels, cafeteria and restaurants) and jams (farmers' cooperative). They purchase fully ripe mango from retailers and farmers for the processing of juice and jam. They play role in satisfying form utility of mango consumers in the study area. Hotels, restaurants, and cafeteria process juice and supply to the consumers in their locality. Farmers' cooperative process mango jams and supplies sample of mango jam to their funding organization in Addis Ababa which in further export to the foreign market. The major inputs that processors use for processing of juice and jams are fully ripe mango, lemon, sugar, mango processing equipments, and cup. The main quality requirement of mango processors is purchasing of colorful red yellow mango, fully ripen, physically undamaged and not bruised mango. The main value adding activities performed by the mango processors in the study area is packing (mainly by farmers' cooperative), freezing, and better storage.

Consumers: These are final users of mango emerging from study area. Consumers for this particular study mean those households who bought and consume mango. They are individual households; they bought mango for their own consumption only either in processed or fresh form. They buy mango either in fresh or processed form from farmers, retailers and processors. Consumers prefer physically undamaged, not bruised, less fibrous and red mango for their immediate consumption.

Brokers: Brokers play an important role in linking farmers to market and other stakeholders of the commodity chain while the ability of market accession of farmers is limited and market demand requires an improvement in quantity as well as diversity of products type. The brokers sometimes go beyond facilitation of transaction and tend to control and fix prices, create price symmetry and make extra benefits from the process in addition to convincing the producers to sale their vegetables at the prices set by wholesalers. The major role of brokers in mango value chain in study area is serving as a bridge for two ways flow of information from traders to farmers and vice versa. The survey has indicated that brokers in the study area are village level brokers who facilitate transaction by convincing farmers to sale his mango and facilitating the process of searching good quality

and quantity mango to traders. Moreover, they inform wholesalers about the harvesting season of mango and whether mango is reached for harvesting.

4.6.2. Supportive sectors/enabling environments

Agricultural Extension Centre: This is the governmental institution which provides extension service for small scale farmers in agricultural sector in the study area. This organization provides various extension services specifically in mango sector in the study area. The major services which this organization is providing in the mango sector are mango breeding, provision of improved mango variety, compost application, harvesting and post harvest handling, and provision of improved harvesting material. The assessment has further indicated that despite extension service is providing technical advice in mango sector, provision of extension service is not covered the whole farming families in the study area.

Woreda Marketing and Cooperative Office: This is also governmental organization which provides marketing services in the certain stages of mango value chain in the study area. This organization provides services like quality control, licensing, and market place for wholesalers, collectors and retailers. The organization provides license to wholesalers emerging from the near area and certifies licensed mango traders to secure their freely involvement in mango transactions. At the same time, the organization prohibits direct entry of unlicensed mango traders in order to uphold the rights of traders who have been licensed. In terms of quality control, the organization prohibits traders who collect immature and unripe mango in rural village. Provision of market place to mango retailers is also through this organization. By performing all this responsibilities, the organization enables mango marketing environment for the traders and sets rules and regulations guiding traders in the study area. But, the study has further indicated that some mango traders like collectors act illegally by collecting immature mango and enter into the business without receiving trade license from the woreda marketing and cooperative office.

Omo-Micro Finance Institution (OMF): This is a non-governmental organization which provides credit and saving services to mango processing cooperative organization and retailers in the study area. This organization provides credit service for the farmers organized

by JICA in small scale mango processing and at the same time provides saving service to the farmers. The organization first provides credit to the farmers for capital investment in mango processing in annual base and in the second term allows farmers to save a certain portion of income obtained from their involvement in mango processing. The organization also provides credit service for mango retailers and wholesalers as initial capital.

JICA/OVOP: This is also the non-governmental organization which is working in the mango sector in the study area in collaboration with the Ministry of Agriculture (MoA). This organization emphasizes on promotion of major product of the particular community to the global market thereby linking particular producers with the market. As the name indicated above OVOP “one village one product promotion project” is working on promotion of mango of the study area at the domestic as well as international markets by organizing mango producers in small scale mango processing unit. The organization facilitates conditions and links mango producers with the OMF institution to acquire initial capital for the processing of mango jam in the form of credit. In addition to this, the organization is working in capacity building of the farmers on small scale mango processing and provides equipments required for mango processing activities. Producers organized in this project supply part of mango jam to the JICA coordination centre in Addis Ababa which in further exports to the foreign country like Japan.

Ministry of Agriculture (MoA): Is the macro level value chain enabler aligned along with the mango producers in collaboration with the JICA. It was engaged in enabling farmers produce one specific agricultural product and supplies it to market by adding some value to the product. The main objective of the program is building capacities of farmers to produce value added products and directly supply it to the market. Ministry of agriculture was also involved in providing training, technical and material support for associations with the support of JICA. The Ministry is promoting the value added products being produced by farmers through the program using bazaars taking place across the country.

4.6.3. Value chain map of mango

Value chain mapping is the process of developing a visual depiction of the basic structure of the value chain. A value chain map illustrates the way the product flows from raw material to end markets and presents how the industry functions. It is a compressed visual diagram of the data collected at different stages of the value chain analysis and supports the narrative description of the chain. Figure 5 shows the overall process of mango value chain in the study area.

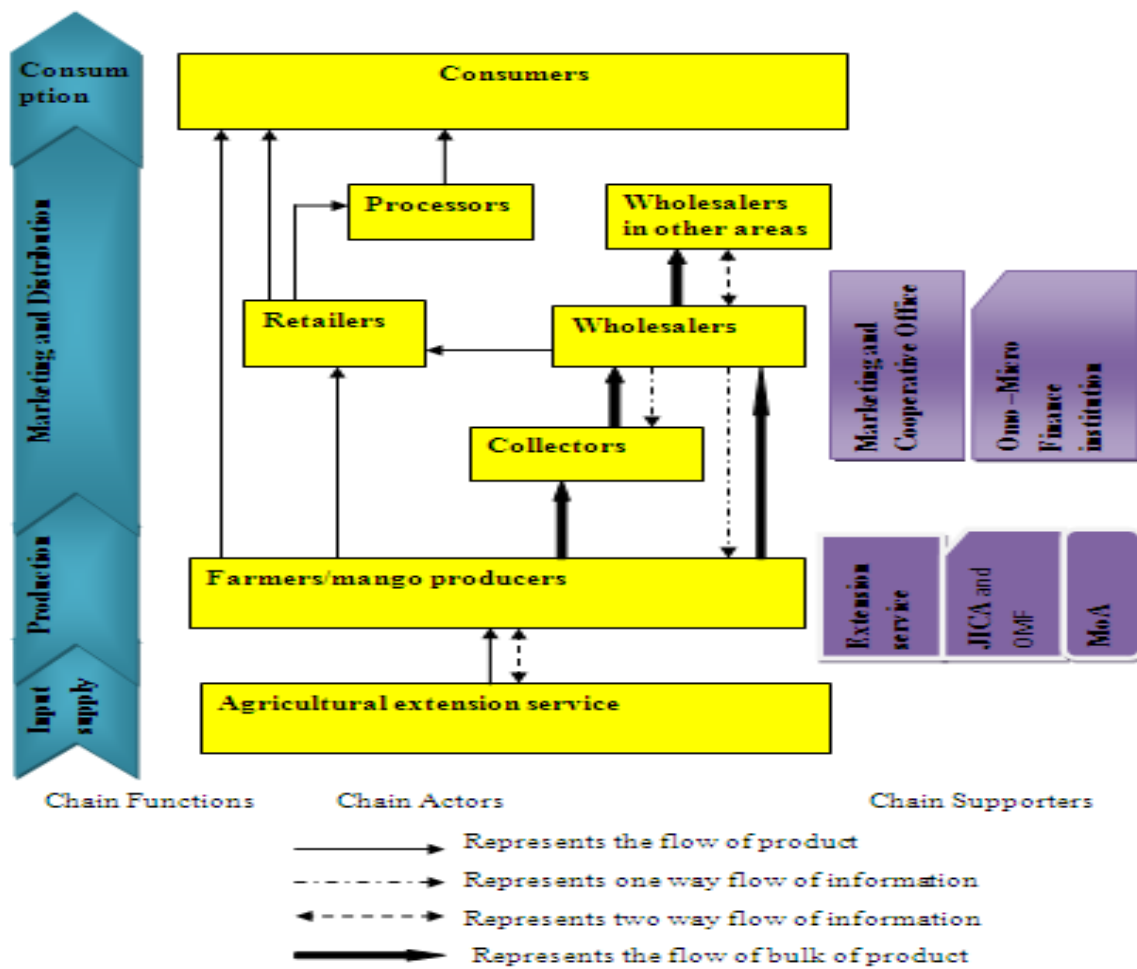


Figure 5: Mango value chain map of the study area

Source: Own sketch from survey result (2015)

4.6.4. Mango marketing channels in the study area

According to Mendoza (1995), marketing channel is the sequence of intermediaries through which whole mango passes from farmers to consumers. The analysis of mango marketing channel was intended to provide a systematic knowledge of how mango flows from its place of production to the final consumers. In order to quantify the volume of mango handled by each marketing actor along the marketing chain, the total purchased amount was multiplied by the share of each marketing actor as obtained from the survey.

About 9 marketing channels were identified together with their total carrying capacity. As shown in the marketing channels, the first 7 channels were found to be operated in around study area where as the next 2 channels were found to be extended to other spatial markets. Channel number 2 is the most important one interms of distributing mango to the end users around the study area thereby carrying about 119.3 quintal of mango. Among the 9 channels identified in the study area, channel number 8 is the most important one interms of the mango carrying capacity (247.55 quintals) followed by the channel number 9 which carries about 161.84 quintal of mango to the end users. The reason why these channels carry out large volume of mango is that wholesalers take away mango to the other mango traders in spatial markets such as Addis Ababa, Awassa, Adama, Desie, Bahirdar, Shashemene, Ziway and Mekele. The flow of mango from production point to the end market indicated that about 57% of mango marketed in 2015 production season was consumed outside the study area.

- I. Producer-----Consumer (52.6 Qts)
- II. Producer-----Retailer-----Consumer (119.3 Qts)
- III. Producer-----Retailer-----Processor-----Consumer (45 Qts)
- IV. Producer-----Collector-----Wholesaler-----Retailer----Consumer (26.33 Qts)
- V. Producer-----Collector-----Wholesaler----Retailer----Processor----Consumer (9.9 Qts)
- VI. Producer-----Wholesaler---Retailer-----Consumer (40.25 Qts)
- VII. Producer-----Wholesaler---Retailer-----Processor----Consumer (15.2 Qts)
- VIII. Producer-----Wholesaler---Wholesalers in Other Area (247.55 Qts)
- IX. Producer---Collector-----Wholesaler-----Wholesaler in Other Area (161.84 Qts)

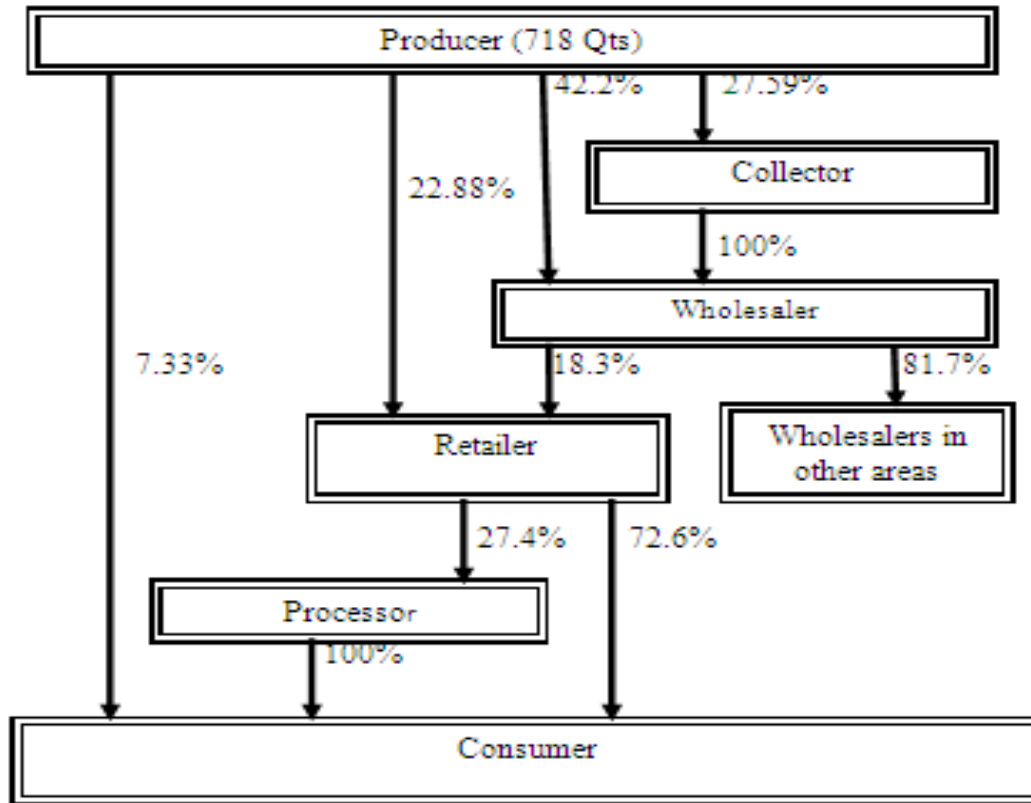


Figure 6: Marketing channel of mango

Source: Own sketch from survey result (2015)

4.6.5. Analysis of market margin along mango value chain

After the value chain has been mapped the next step is to study certain aspects of a value chain in depth. One of these is analysis of the distribution of costs and margins for the actors involved along the different stages of the value chain. The distribution of benefit in the value chain was examined by considering costs, returns and marketing margins. Marketing margin can be used to measure the share of the final selling price that is captured by a particular agent in the value chain. The relative size of various market participants' gross margins can indicate where in the marketing chain value is added and/or profits are made. In order to calculate the marketing margin of an agent, the average price of mango for that

particular agent was taken. Marketing margins, cost structures and benefit share of value chain actors is presented in the Table 19.

Each of the mango value chain actors adding value to the product as the product passes from one actor to another. In a way, the actors change the form of the product through improving the grade by sorting, cleaning or washing or create space and time utility. Table19 indicates different types of marketing costs related with the transaction of mango by all actors and market margin for each actor along the mango value chain.

The arrangement of marketing cost revealed that storage loss is the highest cost for each marketing agents except for processors who incur large cost for processing (manufacturing). This is due to the perishable nature of the product. Thus, the storage loss is the amount highest followed by transportation cost. Processors incur highest cost of all other traders because they incur additional cost for processing.

Accordingly, margin analysis for value chain actors indicated that about 68.4% and 66.33% of profit margin and market margin, respectively, goes to mango processors. This is because they process 150 cup of juice from one quintal of mango and sell each cup of mango with the mean price of 11 birr excluding value added tax. Second to processors, farmers obtain about 10.57% and 12.4% of gross marketing margin and profit margin, respectively, because their marketing cost structure is minimum in relative to other traders. The analysis also revealed that about 10.66%, 7.13% and 5.31% of the gross marketing margin in the mango value chain goes to retailers, wholesalers and collectors, respectively. About 10.3%, 5.24% and 3.7% of the profit margin in the value chain goes to retailer, collector and wholesaler, respectively. The low marketing margin of traders is because of the highest marketing margin obtained by mango processors and their high marketing costs especially wholesalers. In general the study has indicated that about 89.43% of gross marketing margin in mango value chain goes to mango traders and producers earn only about 10.57% of gross marketing margin.

Table 19: Analysis of distribution of margin along mango value chain

Items in br/quintal	Actors along mango value chain					Horizontal summation
	Producer	Collector	Wholesaler	Retailer	Processor	
Purchase price	-	152.5	242.5	316.33	490	1241.33
Production cost	21	-	-	-	-	21
Marketing cost						
Labor for packing	-	1.25	3.00	1.30	-	5.55
Loading and unloading	-	-	4.77	3.50	3.00	11.27
Material cost	-	1.7	4.00	2.50	3.00	11.2
Transport cost	4.70	-	18.00	25	12.00	59.7
Sorting and grading	-	-	3.00	-	-	3.00
Telephone cost	-	5.00	5.00	-	-	10.00
Loss	3.50	8.50	11.50	7.5	3.20	34.20
Processing cost	-	-	-	-	150.00	150.00
Total marketing cost	8.20	16.45	49.27	39.8	171.20	284.92
Overhead costs	3.00	3.30	24.90	3.00	34.00	68.2
Total cost	11.20	19.75	74.17	42.8	205.2	353.12
Selling price	210.14	247.5	370	507	1676.7	3011.34
Marketing margin	189.14	95	127.5	190.67	1186.7	1789.01
% share of margin	10.57	5.31	7.13	10.66	66.33	100.00
Profit margin	177.94	75.25	53.33	147.87	981.5	1435.84
% share of profit	12.4	5.24	3.7	10.3	68.4	100.00

Source: Survey result (2015)

4.6.6. Marketing margins of actors in different channels

Marketing margins of mango in the selected channels for each group of market players is given in Table 20. GMM_f , GMM_c , GMM_w , GMM_r , and GMM_p are gross marketing margins of producers, collectors, wholesalers, retailers and processors, respectively. NMM_c , NMM_w , NMM_r and NMM_p are net marketing margins of collectors, wholesalers, retailers and processors, respectively.

As depicted in the Table 20, Total Gross Marketing Margin (TGMM) is highest in the channel V, III and VII which is 90.6%, 88% and 86%, respectively. The main reason for this is the highest consumer price obtained by the mango processors. The farmers' Gross Marketing Margin (GMM) is highest in the channel I which is the 100% of the consumer price. This is because of the direct sale of mango to the consumers with a good price and lack of intermediaries in the channel. Correspondingly, farmers' gross marketing margin is lowest in the channel number V which is accounted 9.4% of the consumer price. This is because of the involvement of collectors in the channel which pays relatively low price for mango producers. The gross marketing margin of collector is highest in the channel number IV which is accounted about 18.18% of the consumer price. This is because they purchase in relatively cheap price and sell to the other traders with better price. The gross marketing margin of the wholesalers is highest in channel number VI and lowest in channel number V which is about 26.92% and 7.6% of the consumer price, respectively.

The highest Net Marketing Margin (NMM) of the processor, retailer, collector and wholesaler is 63.4%, 48.84%, 14.5%, and 12.66% in channel number III, II, IV and VI, respectively. The lowest net marketing margin of processors, collectors, wholesalers and retailers is 51.2%, 4.25%, 3.08%, and 2.81% in channel number V and VII, respectively. In general processors obtain the highest Gross Marketing Margin (GMM) and Net Marketing Margin (NMM) in the value chain which accounted about 75.67% and 63.4% of the consumer price, respectively, followed by retailers who obtain about 57.4% and 48.84% of the gross marketing margin and net marketing margin, respectively, of the consumer price along the value chain. This is in line with the Ayelech (2011) who indicated that juice houses

(processors), get the highest gross market margin and net market margin of consumer's price in the given channels.

Table 20: Marketing margins for actors along different marketing channels

Marketing margins	I	II	III	IV	V	VI	VII
TGMM	0	57.4	88	72.72	90.6	53.85	86
GMMf	100	42.4	12	14	9.4	46.15	27.27
GMMc	-	-	-	18.18	5.45	-	-
GMMw	-	-	-	20.00	7.6	26.92	8
GMMr	-	57.4	12.2	34.54	14	26.92	5.45
GMMp	-	-	75.76	-	63.63	-	72.62
NMMc	-	-	-	14.5	4.25	-	-
NMMw	-	-	-	6.5	3.08	12.66	3.62
NMMr	-	48.84	9.66	26.7	11.34	18.7	2.81
NMMp	-	-	63.4	-	51.2	-	60.4

Source: survey result (2015)

4.7. Econometric Results

4.7.1. Factors affecting intensity of participation in mango market

Tobit model was used to identify factors affecting farmers' intensity of participation in mango market in the study area. The overall significance and fitness of the model was checked with the value of chi-square; $Pro>chi^2 = 0.000$ which shows that the result is significant at less than 1% level of significance. The log pseudo likelihood value of -253.463 indicates that the assumption of null hypothesis that all predictors in regression model are jointly equal to zero is rejected at less than 1% level of significance. Out of 15 explanatory variables included in the model, about 8 variables were found to be statistically significant at the different significance level. Among the variables included in the model, family size, sex,

postharvest loss and access to non-farm income determined the probability and intensity of participation negatively and variables such as education, quantity of mango produced, owning transport means and access to market information determined positively.

Table 21: Result of Tobit regression

Variables	Marginal effect of E (y*/y>0)	Std.error	Z	P>Z	Marginal effect of Pr(y>0)	Marginal effect of E(y/y>0)
AGE	0.0119	0.0145	0.82	0.411	7.1*e ⁻⁰⁵	0.116
FMSZ	-0.249	0.1189	-2.11	0.037**	-0.00148	-0.243
SEX	-0.818	0.3251	-2.53	0.013**	-0.00528	-0.795
EDUC	0.985	0.4894	2.02	0.045**	0.00585	0.959
DISNEAMKT	-0.0094	0.0065	-1.45	0.150	-5.6*e ⁻⁵	-0.0091
ACCEXSER	0.494	0.3163	1.57	0.119	0.003335	0.480
ACCCRE	0.308	0.3390	0.91	0.363	0.00199	0.299
QUANMAPR	0.548	0.1124	4.90	0.000***	0.00325	0.534
ACCMKT	0.237	0.6791	1.35	0.234	0.0249	1.450
OWNTRAME	1.209	0.4331	2.80	0.006***	0.00637	1.181
ACMKTINFO	0.783	0.3804	2.07	0.041**	0.0061	0.757
PRICE	0.082	0.0650	1.27	0.208	4.8*e ⁻⁰⁴	0.079
POSTLOSS	-0.061	0.0031	-1.97	0.051*	-4*e ⁻⁰⁵	-0.006
INCOTHE	-0.0009	0.00012	-0.74	0.458	-5.3*e ⁻⁰⁷	-8.8*e ⁻⁰⁵
ACNONFAIN	-1.272	0.4358	-2.94	0.004***	-0.01292	-1.222

N = 138, dy/dx is marginal effect, left censored observations = 18, uncensored observations = 120, F (15, 123) = 58.22, Prob > F = 0.0000, Log pseudo likelihood = -253.463, Pseudo R² = 0.3756, ***, ** and * is significant at 1%, 5% and 10%, respectively

Source: Survey result (2015)

Family size affected probability and intensity of participation negatively at 5% level of significance as depicted in Table21. A one unit increase in family size decreases the

probability and intensity of participation of mango producers by 0.148% and 24.9%, respectively, keeping other variables constant. The actual quantity of mango supply conditional on decision to participate in the market also decreases by 24.3% if the family size increases by a unit. This implies that as family size increases, consumption of mango at household level increases and increased consumption of mango may lead to decrease in quantity of mango supplied to the market. This is in line with Adenegan *et al.* (2013) who indicated that larger household size in the study area consumed more of what they produced rather than participating in the cassava output market.

Sex affected the probability and intensity of participation negatively at 5% level of significance. Being female headed decrease the probability and intensity of participation in mango market by 0.585% and 81.8%, respectively, holding other variables constant. The actual sales level of mango conditional on decision to participate decreases by 79.5% if the household head is female. This is in line with the Adenegan *et al.* (2013) who indicated that market participation intensity increases if the household head is male. Also Baden (1998) and World Bank (2003) indicated that women generally produce for more localized spot markets and in small volumes than men, and when they are involved in marketing of agricultural produce, they tend to be concentrated at the lower levels of the supply or value chain, in perishable or low value products. Education of households positively correlated with the probability and intensity of participation in mango market at 5% level of significance. When a farmer is getting educated, the probability and intensity of participation in mango market increases by 0.538% and 98.5%, respectively, holding other variables constant. The amount of mango sales conditional on decision to participate in market also increases by 95.6% when the farmer is getting educated. This implies that educated farmers have a good ability of analyzing market condition and better exposure to the new ideas emerging from market. Quantity of mango produced affected the probability and intensity of participation of mango producers positively at less than 1% level of significance thereby increasing likelihood and intensity of participation by 0.325% and 54.8%, respectively, keeping other variables constant. The amount of mango sales conditional on decision to participate in market increases by 53.4% when quantity of mango produced increases by unit quintal. This implies that as quantity of mango produced increases, surplus of mango goes to market increases thereby contributing to the strong involvement of farmers in the market.

Owning transportation means has positive correlation with the probability and intensity of market participation at less than 1% level of significance. Owning of transport means increases the probability and intensity of participation by 0.637% and 120.9%, respectively, keeping other variables constant. The actual quantity of mango supply conditional on decision to participate also increases by 118.1% for households who own transport means. This implies that an on-farm transport facility owned by the farmers fosters intensive involvement of farmers in the market thereby reducing cost of transaction from production point to the sale. The result also revealed that access to market information has a positive correlation with probability and intensity of participation in mango market at 5% level of significance. Access to market information by mango producer increases the probability and intensity of participation by 0.61% and 78.3%, respectively, keeping other variables constant. And the amount of mango supply followed by decision to participate in the market increases by 75.7% if there is access to market information. This implies that access to information related with the price, supply and demand of mango in the market increases farmers' participation in mango market. This is in line with the Omiti *et al.* (2009) who found that market information were key incentives for increased sales.

Post harvest loss is found to be statistically significant at 10% level of significance thereby reducing the probability and intensity of participation by 0.004% and 6.1%, respectively, keeping other variables constant. The quantity of mango supplied to the market followed by the decision to participate decreases by 0.6% when post harvest loss increases by one unit quintal. This implies that post harvest loss of mango during harvesting and storage causes decrease in amount of mango supplied to the market which in turn decreases intensity of participation of farmers in mango market. Access to non-farm income is negatively correlated with the probability and intensity of participation in mango market at less than 1% level of significance. Farmers' access to non-farm income decreased the probability and intensity of participation in mango market by 1.292% and 127.2%, respectively, keeping other variables constant. And the actual sale of mango followed by the decision to participate also decreases by 122.2% when farmer has access to non-farm income. This implies that earning better income from non-farm activities like trading discourages farmers' intensity of participation in mango market because of the diversion of attention to better income generating activities. This is in line with the Adenegan *et al.* (2013) who indicated that

access to non-farm activity affected market orientation of cassava producers negatively in Nigeria.

4.7.2. Factors affecting choice of mango market outlets

The multivariate probit model was estimated jointly for four binary dependent variables namely wholesaler, collector, retailer and consumer market outlets. The P-value of the Wald test statistics for the overall significance of the regression is low (0.0268) indicating that the multivariate regression is significant. Further, the likelihood ratio test of rho is significant (P-value = 0.0133) indicating that a multivariate probit specification fits the data. The significance of the off-diagonal elements of the covariance matrix shows that there are unobserved heterogeneities that influence the choice decisions on the different market outlets. The correlation coefficients among the error terms are significant indicating that the decision to choose one market outlet affects the decision of choosing the other. The correlation coefficients between the wholesaler and consumer and collector and consumer market outlets is negative and significant at the 5% level indicating that farmers who choose one market outlet are less likely to choose another (APPENDICES: Table 4).

According to the result obtained from the multivariate probit model, the probability of choosing wholesaler market outlet was influenced by family size, distance to the nearest market centre, quantity of mango produced and price as indicated in Table 22. Family size is positively correlated with the choice of wholesaler outlet at less than 1% level of significance, respectively. This is due to the fact that households with the larger family size have plenty of labor force to deliver mango to final market. This is in line with the Tewodros (2014) who indicated that large family size implies better labour endowment so that households are in a position to travel to get wholesalers in the district or nearby town markets. Distance to the nearest market centre is negatively correlated with the choice of wholesaler market outlet at 5% level of significance. This indicates that when distance to the nearest market is increasing, the likelihood of selling mango to the wholesale market outlet is decreasing because of the transaction costs related with the delivering of mango.

Table 22: Result of multivariate probit regression

Variables	Market outlets							
	Wholesaler		Collector		Retailer		Consumer	
	Coef.	P>/Z/	Coef.	P>/Z/	Coef.	P>/Z/	Coef.	P>/Z/
AGE	-0.0053	0.726	0.0057	0.603	0.0084	0.510	0.0077	0.538
FMSZ	0.3420	0.002***	-0.1074	0.081*	0.0411	0.551	0.0716	0.225
SEX	-0.2493	0.608	-0.3862	0.215	-0.1434	0.640	0.2102	0.539
EDUC	-0.5835	0.168	0.2075	0.491	-0.1272	0.678	0.0714	0.815
DISNEAMKT	-0.0337	0.026**	-0.0160	0.025**	-0.0095	0.111	-0.0005	0.937
ACCEXSER	0.4320	0.389	-0.3965	0.330	-0.0229	0.956	0.1216	0.735
ACCCRE	-0.3907	0.442	0.1865	0.581	0.2131	0.535	-0.1674	0.620
QUNMAPR	0.1322	0.009***	0.0367	0.092*	-0.0698	0.005***	-0.0644	0.004***
ACCMKT	-4.1063	0.984	-0.0723	0.940	-3.494	0.989	1.4949	0.154
OWNTRAME	0.5915	0.428	-0.702	0.860	0.2533	0.558	-0.1017	0.793
MEMBER	0.3413	0.557	-0.0940	0.822	-0.2826	0.568	0.2569	0.569
ACMKTINFO	0.1502	0.772	-0.1432	0.644	-0.3554	0.321	0.5238	0.070*
PRICE	0.4367	0.001***	-0.2287	0.014**	-0.3729	0.004***	0.6270	0.003***
ACNONFAIN	-0.0835	0.843	-0.6245	0.033**	-0.1250	0.683	0.3688	0.215
Constant	7.8076	0.970	1.4692	0.249	5.483	0.982	-2.874	0.045**

N=120, Wald chi2 (56) = 78.18, Prob>chi2 = 0.02668, log likelihood = -204.49657, rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0 where 1, 2, 3 and 4 stands for wholesaler, collector, retailer and consumer, respectively, ***, ** and * are statistically significant at 1%, 5% and 10% level, respectively

Source: Survey result (2015)

Quantity of mango produced also determined the choice of wholesaler market outlet positively at less than 1% level of significance. This indicates that when quantity of mango produced increases, probability of selling to the wholesalers is increasing because wholesalers purchase high quantity of mango at once without selection. The price paid for a unit kg of mango determined the choice of wholesaler market outlet positively at less than 1% level of significance. This is due to the fact that wholesalers purchase mango without any

selection and overestimate the price paid for a unit kg of mango in relative to other market outlets.

The probability of choosing collector market outlet was determined by the family size, distance to the nearest market, quantity of mango produced, price and access to non-farm income as indicated in the Table 22. Family size determined the probability of choosing collector outlet negatively at 10% level of significance. This implies that large family size has a plenty of labor force for delivering of mango to the final market and plenty of labor force disfavor selling of mango to the collector market which pays low price at farm gate. Distance to the nearest market centre is also negatively correlated with the probability of choosing collector outlet at 5% level of significance. This implies that when distance to the nearest market increases, transaction cost of delivering mango to the final market also increases and because of this farmers choose to sell at farm gate with few transaction cost. Quantity of mango produced determined the choice of collector market outlet positively at 10% level of significance. This implies that collector can purchase a significant volume of mango at farm gate which in further sell to other traders like wholesalers. The probability of selling mango to the collector market outlet choice is negatively correlated with the price paid for a unit kg of mango at farm gate at 5% level of significance. This indicates that a low price worth to unripe mango by collectors at farm gate discourages farmers from selling their mango to the collectors. This is in line with Montshwe (2006) who stated that farm gate sale tends to reduce farmers' revenue since the prices are relatively low. Access to non-farm income determined the probability of choosing collector outlet negatively at 5% level of significance. This is due to the fact that farmers who have access to non-farm income are not quick enough to harvest immature mango for temporary cash need because they can derive income needed for the households' basic needs from other activities like trading. In other case, they can derive income from non-farm activities which enable them to sell mango at formal market.

The probability of choosing retailer market outlet was determined by the quantity of mango produced and price as indicated in the Table 22. The two variables determined the probability of choosing retailer market outlet negatively at less than 1% level of significance. The negative correlation in the case of quantity of mango produced implies that famers who

produce a large volume of mango prefer wholesale market than retailer as retailers purchase a small quantity of mango. In the case of price, retailers often underestimate the price paid for a unit kg of mango and try to deceive farmers thereby reflecting their bargaining ability.

The probability of choosing consumer market outlet was determined by quantity of mango produced, access to market information and price as indicated in Table 22. Quantity of mango produced is negatively correlated with the probability of choosing consumer outlet at less than 1%. This implies that farmers who produce a high quantity of mango do not prefer selling of mango to the consumers because consumer demands a small quantity of mango for spot consumption. Access to market information determined the probability of the choosing consumer outlet positively at 10%. Price information about local market informs the farmer on prevailing pricing condition. This implies that accessibility of market information related with price condition in local market fosters choice of consumer in local market. This is in line with the Geoffrey *et al.* (2014) who indicated that market price information had a positive influence on the choice of the local market. Price paid for the unit kg of mango also determined the probability of choosing consumer outlet positively at less than 1% level of significance. This implies that end user of the product pays a better price for ripen mango in local market and indicates that farmers who sell ripen mango can drive better income.

4.8. Constraints and Opportunities of Mango Value Chain in the Study Area

4.8.1. Constraints of mango production

The survey assessment has revealed that major problems of mango production in the study area are lack of technology, limited supply of improved mango variety, seasonality and weather related problems, lack of use of credit service, lack of irrigation, pests and diseases, harvesting and post harvest handling problems, low level of extension service provision and low level of knowledge and skill on efficient use of the mango product as shown in Table23.

Table 23: Constraints of mango production in the study area

Items	N	%
Lack of technology	30	21.74
Limited supply of improved mango variety	27	19.56
Seasonality and weather related problems	12	8.7
Lack of use of credit service	23	16.67
Lack of irrigation	10	7.25
Pests and diseases	4	2.9
Low level of extension service provision	24	17.4
Low level of knowledge and skill	8	5.8
Total	138	100.00

N = frequency, % = percentage

Source: survey result (2015)

Lack of technology: About 21.74% of sample respondents have replied as there is lack of technology in mango production. This is related with low level of the use of improved mango production systems such as mango breeding, use of agro-chemicals which kill plant pests and mango planting systems. Traditional way of planting mango without keeping spacing is also common problem of mango production in the study area.

Limited supply of improved mango variety: Majority of mango producers in the study area use local mango variety. The current supply of improved mango variety is insignificant in comparison to the demand and distributions of improved mango variety do not covered the whole members of society. Extension centre provides only apple mango variety for a limited number of farmers mainly for practical purpose. There is no supply of diverse number of mango varieties like Tommy Atkins and Kent mango variety which are quite important for production and productivity.

Low level of extension service provision: Extension service in the area is mainly oriented on providing technical service for other crops such as cereals and grains production. There is limited implementation of technical packages in fruit in general and mango sector in particular in the study area which might reduce the awareness level of farmers on benefits of mango for income and food security. Moreover, provision of technical packages like mango breeding, harvesting and postharvest handling, transplanting, and compost/farmyard manure application is inadequate and significant members of the society are uncovered. This is in line with the Belay (2003) who indicated that agricultural extension service has failed to bring major impact on productivity of fruits due to weak link between stakes and associate workloads of extension agents.

Low level of knowledge and skill: Majority of farmers do not give special attention to mango production because of emphasizing mainly on production of staple food items like cereals and consider mango as petty agricultural commodity. This is because of their low level of accessing information related with the market demand of mango. Farmers do not have knowledge on improved production technology, and there is little or no use of fertilizers and pesticides. A significant portion of mango fruit is goes to loss at farm level due to poor management. Exploitation of immature mango by household members and tame animals is also a common limitation of mango production in the area. This is in line with the James, *et al.* (2008) who indicated that due to the highly seasonal nature of the mango crop, and also the tendency to prioritize food security with grain crops, mango growing is not the main livelihood activity for most farmers, and is generally considered as a complementary activity to other farming practices.

Lack of use of credit service: Despite credit service is accessible to majority of farmers in the study area; there is limited use of credit for mango production and marketing. Even if credit is important to facilitate the introduction of innovative technologies and for input and output marketing arrangements, majority of the farmers believe that mango can be produced with the zero economic cost and they do not need to incur cost for mango transaction activities. In addition to this, credit provision arrangement is not targeted on mango production and marketing systems in the study area. This is in line with the Ayelech (2011)

who indicated that even if micro-finance and governmental and private banks are available in the study area no credit is reported by the respondents from formal banks. In addition to this, lack of small scale irrigation, seasonality and weather related problems, pests and disease are also highlighted during the survey period as the major constraints of mango production in the study area.

4.8.2. Opportunities of mango production in study area

Potential opportunities perceived for the sustainable production of mango in the study area include suitable agro ecological zone with favorable weather conditions, abundance of locally accessible inputs like compost/farmyard manure, plenty of labor force, fertile arable land and market. Urbanization and rapidly growing population size is also perceived as a potential opportunity for mango production as these factors force farmers to produce more in order to meet market demand. In addition to this, woreda extension centre is intending to prepare nursery site for the rising of different mango cultivars which are friendly with the local conditions. Moreover, the current government policy dimension is emphasizing in horticultural sector in Growth and Transformation Plan (GTP) in order to promote the sector from small scale production to commercialization and agro processing. The assignment of crop experts at micro level based on their academic back ground for the increasing production and commercialization of agricultural sector is also important policy dimensions. Credit and saving institutions like OMF institution and commercial bank of Ethiopia are accessible for small scale farmers in the study area which boost their production and marketing capacity. Arbaminch agricultural research centre is engaged in specializing fruit and vegetable crops in the catchment areas. This is quite indispensable for research and development work in fruit sector and provision of improved mango cultivars in the regions.

4.8.3. Constraints of mango marketing

During the survey period, different constraints related with the mango marketing in the study area were identified in participatory manner with key informants, farmers, traders and woreda officials.

Table 24: Constraints of mango marketing in the study area

Items	N	%
Lack of farmers' cooperative	30	25
Low price of mango	17	14.2
Lack of potential market	5	4.2
Inadequacy of transport facility	11	9.2
Lack of market information	10	8.3
Low level of farmers' bargaining power	7	5.8
Perishability	23	19.2
Lack of proper storage and postharvest management	17	14.2
Total	120	100

N = frequency, % = percentage

Source: survey result (2015)

As depicted in the Table24, about 25%, 19.2%, 14.2%, 14.2%, 9.2% and 8.3% of sample households replied that lack of cooperative, perishability of mango, lack of proper storage and postharvest management, low price of mango, inadequacy of transport facility and lack of market information, respectively, are the major constraints of mango marketing in the study area. The survey has further revealed that low level of farmers' bargaining power and lack of potential market are also constraints that farmers' facing in the study area. Moreover, lack of agro processing enterprise is reportedly mentioned as the major constraint of mango marketing in the study area. Data obtained from mango traders indicated that high post

harvest loss during transportation and collection point, price volatility, quality management, seasonality of mango; high transaction cost and illegal entry of some traders are the major problems of mango marketing. Exporting of mango to the Djibouti is completely blocked due to poor access to cargo facility at terminal market and lack of cold chain logistic and this is highlighted as potential constraint of mango marketing. In addition to this, the survey has further revealed that lack of government support is the major constraint of mango traders in the area.

4.8.4. Opportunities of mango marketing

The potential opportunities of mango marketing in the study area may include access to market, access to transport facility like road and vehicle, access to credit and so on. Woreda marketing and cooperative office is endeavoring to assure mango quality and regulates the market. Assignment of marketing experts for quality control and market follow up is considered as the opportunity for mango quality management. Potential entry of buyers in mango marketing and continuous demand for either fresh or processed mango products is also one of the potential opportunities of mango marketing. Moreover, the government policy dimension on commercialization of agriculture and major emphasis on horticultural and fruit sector stimulates the intensive involvement of small scale farmers as well as traders in mango marketing. Establishment of mango processing enterprises like Seka agro processing enterprises is quite important for absorption of mango from different regions of the country.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary and Conclusion

Mango sub-sector is a good entry point for tackling poverty and that the market for mangoes is significant and growing in Ethiopia. Mango is one of potential fruit crop which has a significant contribution to the livelihood of small scale farmers and creates business and employment opportunities for the many firms and commercial agents in the study area. This study was carried out with the main objective of identifying mango value chain actors and their respective functions, analyzing distribution of margins along mango value chain, identifying factors affecting intensity of farmers' participation in mango market and outlet choice decision.

In line with the objective of the study, value chain analysis indicated that there are direct and indirect actors who can take their part in each and every stages of the mango value chain in the study area. The direct actors of mango value chain are input suppliers, producers, collectors, wholesalers, retailers, processors and consumers. The indirect actors of mango value chain in the study area are both governmental and non-governmental organizations such as Agricultural Extension Centre, Marketing and Cooperative Office, Trade and Industry Department, Ministry of agriculture, (JICA/OVOP) and Omo Micro-Finance (OMF). In addition to this, major value adding activities performed by the mango value chain actors include provision of inputs, production, sorting, grading, drying, processing, transporting and distributing which in further adds form, time spatial value of the product.

The distribution of benefits in the value chain was examined by considering costs, returns and marketing margins along the chain. Accordingly, margin analysis for value chain actors indicated that about 66.33% and 68.4% of market margin and profit margin, respectively, goes to mango processors followed by producers who obtain about 10.57% of market margin. In general the study has indicated that about 89.43% of gross marketing margin in mango value chain goes to mango traders and producers earn about 10.57% of gross marketing margin. Marketing margins of mango in the channels for each group of market players has indicated that total gross marketing margin (TGMM) is highest in the channel V,

III and VII which is 90.6%, 88% and 86%, respectively. The farmers' gross marketing margin (GMM) is highest in the channel I which is the 100% of the consumer price. The highest net marketing margin (NMM) of the processor, retailer, collector and wholesaler is 63.4%, 48.84%, 14.5% and 12.66%, in channel number III, II, IV, and VI, respectively. In general processors obtain the highest Gross Marketing Margin (GMM) and Net Marketing Margin (NMM) in the value chain which accounted about 75.67% and 63.4% of the consumer price, respectively.

Estimation of Tobit model revealed that out of 15 explanatory variables included in the model, about 8 variables were found to be statistically significant at conventional significance level. Variables such as family size, sex, postharvest loss and access to non-farm income determined farmers' intensity of participation in mango market negatively and variables such as education, quantity of mango produced, owning transport means and access to market information affected positively at conventional significance level. The result obtained from the MVP model revealed that about six variables were found to be statistically significant at conventional significance levels by determining the choice of wholesaler, collector, retailer and consumer market outlets. The result has indicated that variables such as family size, distance to the market, quantity of mango produced and price offered determined the choice of wholesale market outlet. Farmers' choice of collector market outlet is determined by the family size, distance to the nearest market, quantity of mango produced, price offered and access to non-farm income. The choice of retailer market outlet is determined by the variables such as quantity of mango produced and price offered. Consumer market outlet choice is determined by the variables such as quantity of mango produced, price offered and access to market information.

The study has further indicated potential constraints and opportunities related with the mango production and marketing in the study area. Major problems of mango production in the study area are lack of technology, limited supply of improved mango variety, seasonality and weather related problems, lack of use of credit service, lack of irrigation, pests and diseases, harvesting and post harvest handling problems, low level of extension service provision and low level of knowledge and skill on efficient use of the mango product. Conversely, suitable agro ecological zone with favorable weather conditions, abundance of locally

accessible inputs like compost/farmyard manure, plenty of labor force, fertile arable land and market, urbanization and rapidly growing population size and availability of credit and saving institutions is perceived as the potential opportunities of mango production. The major constraints of mango marketing are lack of cooperative, perishability, lack of proper storage and postharvest management, low price of mango, inadequacy of transport facility and lack of market information. Nevertheless, the government policy dimension on commercialization of agriculture and major emphasis on horticultural and fruit sector stimulates the intensive involvement of small scale farmers as well as traders in mango marketing.

5.2. Recommendations

Based on the result obtained from the current study the following are anticipated to be done for the further improvement of mango value chain in the study area.

Capacity building of farmers on agronomic practices like orchards spacing, technological application, use of improved mango varieties and overall farm management are key to the development of the mango value chain thereby improving mango production system. Strengthening of agricultural extension service in dissemination of improved mango variety and technical service provision is quite important. Therefore, attention should be paid on enhancement of technological frameworks in mango sector.

Cooperative is quite important for group marketing and strengthening of farmers' bargaining power and pooling of resources for the intensive involvement of farmers' in the market and keeps up the farmers' economic benefit. Therefore, farmers' mango marketing cooperative should be established in the study area and programmes aimed at commercialization of mango sub-sector should be designed. Post harvest loss of mango along the value chain is the major cost structure for mango value chain actors and negatively correlated with the farmers' intensity of market participation in Tobit regression. Therefore, designing development programmes on reduction of post harvest loss of mango and promoting cold chain logistic system along the mango value chain is quite important for all actors in the chain. In addition to this, provision of improved mango harvesting material is quite prominent to reduce postharvest loss of mango at farm level and attention should be given on it.

Family size of the households is above the national average and is negatively correlated with intensity of market participation in Tobit regressions. Therefore, promoting family planning program is quite important for the intensive involvement of farmers in the market. Educational coverage should be strengthened for further. Establishment of small scale agro-processing enterprises and empowering of small scale farmers to be engaged in vertical integration is quite important for the efficient use of mango products and maximizing the economic benefit. Sex of the household determined the intensity of market participation negatively. This informs the necessity of promoting gender equality and women empowerment in participation and intensity of participation in mango market particularly and rural economic sector in general. Access to market, access to market information, credit and quantity of mango produced should be promoted and strengthened for the further improvement of mango value chain and commercialization of smallholder farmers in the study area.

Concerning to market outlet choice, variables affecting the choice of wholesaler and consumer market outlet should be promoted and farm gate and retail price intervention is quite important to maximize the benefit of farmers. Quantity of mango produced and price are the key determinants of households' market outlet choice. Therefore, these variables should be promoted and get special attention. Value chain governance and coordination among actors in mango value chain in the study area is poor. Therefore, creating marketing network among actors is quite important for value chain coordination, innovation and development.

In general, policy initiatives aiming at increasing farmers' access to mango technologies, developing and improving market information, gender consideration, cooperative development, postharvest loss, innovation, improving extension system and credit are recommended to accelerate the development of mango value chain in the study area. Further investigations emphasizing on economic analysis of post harvest loss of mango along the value chain in-depth and determinants of postharvest loss of mango at farm level and along the whole value chain should get attention.

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APPENDICIES

Appendix I

Table 25: Multicollinearity detection of continuous variables

Variables	VIF	1/VIF
QUANMAPR	2.04	0.489515
POSTLOSS	1.46	0.685394
FMSZ	1.42	0.703888
INCOTHE SALE	1.37	0.729475
AGE	1.18	0.849732
PRICE	1.05	0.950944
DISNEAMKT	1.05	0.955184
Mean VIF	1.37	

Source: Survey result (2015)

Table 26: Multicollinearity detection of dummy variables

	SEX	EDUC	ACCEXS ER	ACC MKT	ACCCR E	OWNTR AME	ACMK TINFO	ACNO NFAIN
SEX	1.0000							
EDUC	-0.0111	1.0000						
ACCEXSER	-0.0264	0.4278	1.0000					
ACCMKT	-0.0559	0.5119	0.4460	1.0000				
ACCCRE	-0.0584	0.1232	0.2074	0.2143	1.0000			
OWNTRAME	0.0595	0.5494	0.2335	0.3084	0.0112	1.0000		
ACMKTINFO	0.0734	0.1713	0.1016	0.1228	0.1206	0.0379	1.0000	
ACNONFAIN	-0.1308	0.0019	0.0091	0.0612	0.0886	-0.0104	0.0612	1.0000

Source: Survey result (2015)

Table 27: Heteroscedasticity test of the variables

Source	Chi2	Df	P
Heteroscedasticity	136.83	125	0.2214
Skewness	29.60	15	0.0135
Kurtosis	3.60	1	0.0578
Total	170.03	141	0.0483

Source: Survey result (2015)

Table 28: Error covariance matrix and correlations of the MVP model

Correlation	Coef.	Std.err	Z	P> Z/
/atrho21	.4940	.2165	2.28	0.023**
/atrho31	.2891	.2340	1.24	0.217
/atrho41	-.5951	.2529	-2.35	0.019**
/atrho32	-.1642	.1982	-0.83	0.408
/atrho42	-.5990	.2424	-2.47	0.013**
/atrho43	.3225	.1947	1.66	0.098*
Rho21	.4573	.1712	2.67	0.008***
Rho31	.2813	.2155	1.31	0.192
Rho41	-.5335	.1810	-2.95	0.003***
Rho32	-.1627	.1930	-0.84	0.399
Rho42	-.5363	.1727	-3.11	0.002***
Rho43	.3117	.1758	1.77	0.076*

Likelihood ration test of $\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$ where 1, 2, 3 and 4 stands for wholesaler, collector, retailer and consumer, respectively, Chi2 (6) = 16.0803, Prob>chi2 = 0.013, ***, ** and * are statistically significant at 1%, 5% and 10% level, respectively.

Source: Survey result (2015)

Appendix - II

Interview Schedules

Producers survey schedule

General instruction

- ✓ *Make brief introduction before starting any question, introduce yourself to the farmers and make clear the objective of the study*
- ✓ *Avoid arrogance and over action*
- ✓ *Name of the respondent is kept confidential*
- ✓ *Please fill the interview schedule according to the farmers reply (do not put your own feeling).*
- ✓ *Please ask each question clearly and patiently until the farmer gets your points.*
- ✓ *Please do not use jargon and ambiguous words and do not forget local units.*
- ✓ *During the process write answers on the space provided (for close ended questions use “✓” to pick up the answer)*
- ✓ *Prove that all the questions are asked and the interview schedule format is properly completed*

Demographic information

1. Age: _____
2. Family size: _____
3. Sex: 1. male 2. female
4. Educational status:

No formal education	Primary school	Junior secondary	Secondary school	certificate	diploma	Degree

5. Marital status:

Single	Married	Widowed	Divorced

6. Occupation:

Farmer	Business man	Employed	Others, specify

Area Information

7. Name of kebele Administration -----
8. Distance of your residence from the nearest market center _____ Km or _____ walking time (minutes/hrs).

Production Aspects

9. What is your livelihood system?

Farming	Trading	Government worker	Others, specify

10. If your answer for question number 12 is farming, what kind of farming system do you use? Tick the appropriate one! Tick the appropriate one!

Crop-livestock production	Only crop	Only livestock	Others, specify

11. Mention livestock animals under your production system?

12. Mention all types of crops produced in your production system

Crops	Types/description	Annual income	Rank
Cereals			
Fruits			
Vegetables			
Legumes			
Others, specify			

13. Which fruits are your major means of income (put in rank)?

	Avocado	Mango	Papaya	Orange	Others, specify
Rank					

14. If you produce mango, what production system do you use to produce mango?

Sole planting	Intercropping	Backyard garden	Others, specify

15. For what purpose do you produce mango?

1. For sale 2. For consumption 3. Both

16. How long have you practiced production of mango? _____ years

Inputs and Source of Inputs

17. What kind of variety do you use to produce mango?
 1. Local variety 2. Improved variety 3. Both
18. From where do you get mango variety for your production purpose? (multiple response is possible)

-
19. What kind of inputs do you use to produce mango (multiple response is possible)?
 1. Fertilizer 2. Compost 3. Farm yard manure 4. Others, specify
20. From where do you get these inputs for mango production) (multiple responses are possible?)

Extension centre	Market	Agricultural research centre	Own stock	Other farmers	Private input suppliers	Others, specify

21. What type of planting material do you use to produce mango?
 1. Local material 2. Improved material 3. Both
22. What local materials do you use to produce mango?
 _____?
23. What are improved materials do you use to produce mango?
 _____?
24. What is the total number of mango trees under production _____?
25. What is your source of labor during production period?

Family labor	Hired labor	Labor exchange	Cooperation	Others, specify

26. What is the number of bearing and non-bearing mango trees? _____ and _____, respectively?

Access to Services

27. Do you have access to extension service?
 1. Yes 2. No
28. If your response for question number 32 is yes, what kind of services do they provide to you? (multiple response is possible)

Seed bed preparation	Fertilizer/compost application	Harvesting	Transplanting	Marketing of mango	Post harvest handling	Others, specify

29. Do you have access to credit? 1. Yes 2. No
30. If your answer for question number 34 yes, what are the sources of credit (multiple response is possible)

Relatives	Bank	Micro finance	Friends	Traders	NGOs	Venture capital	Credit and saving coop	Others, specify

31. If your answer for question number 34 is yes, did you receive credit for mango production in 2014 cropping season? 1. Yes 2. No
32. If your answer for question number 36 is Yes, for what purpose did you receive credit (multiple responses are possible)?

To purchase fertilizer for mango	
To rent in land to extend mango production	
To purchase seed/seedling of mango	
To purchase transporting means	
Others, specify	

33. Are there organizations/institutions which provide technical services on mango production? 1. Yes 2. No
34. If your response for question number 38 is yes, what kind of organizations are they?
1. Governmental organizations 2. Non-governmental organizations
35. If your response for question number 38 is Yes, what kind of services do you get from these organizations (multiple response is possible)
-

Harvesting of mango

36. At what time/season do you harvest mango?
1] September-November 2] December- February 3] March-May 4] June-August

37. At what stage do you harvest your mango produce?

Harvesting fully ripen mango	
Harvesting partially ripen mango	
Harvesting unripe mango	

38. How do you harvest mango _____?
1. Hand picking 2. Cut by scissors 3. Using sticks 4. Others
39. How many times do you harvest mango in one year _____?
40. What is the amount of mango did you produce? _____ quintal
41. How much cost do you incur to produce a one quintal of mango? _____ birr
42. What are the major constraints of mango production in the area?

Problems	Tick the appropriate	What is the solution (say something)
Harvesting and post harvest handling		
Pests and diseases		
Limited research and development		
Lack of irrigation		
Lack of improved mango varieties		
Birds and predators		
Others, specify		

Marketing Aspect

43. Do you sell your mango product?
1. Yes 2. No
44. If your response for question number 48 is yes, what amount of mango do you supply to the market? _____ quintal
45. How long did you participate in mango marketing? _____ years
46. Do you have access to roads? 1. Yes 2. No
47. If yes, what kind of road? _____?
48. Do you have access to market? 1. Yes 2. No
49. If your response for question number 51 is Yes, what is place of market for selling mango?
1. Farm gate 2. Local market 3. Town 4. Road side 5. Others, specify
50. Do you have your own transportation means? 1. Yes 2. No
51. What kind of transportation means do you use to deliver mango to the market?
1. Donkey 2. Cart 3. Human back 4. Vehicle 5. Others, specify
52. What kind of packing material do you use to pack your mango produce?
1. Basket 2. Can 3. Plastic box 4. Wooden box 5. Others, specify
53. Do you have long standing relationship with traders? 1. Yes 2. No
54. If your answer to question number 56 yes, with which traders? 1. Wholesalers 2. Collectors 3. Retailers 4. Processors 5. Consumers 6. Others, specify
55. Are you a member of any organization? 1. Yes 2. No
56. If your answer for question number 58 is Yes, what is the name of the organization?
- _____
57. To whom do you sell your mango product? (multiple response is possible)

	Wholesalers	Retailers	Collectors	Processors	Consumers
Quantity sold in kg					

58. To whom do you sell most of your mango product?

Place	Tick the appropriate	Reason
Wholesalers		
Collectors		
Processors		
Consumers		
Retailers		
Others, specify		

59. What general problem do you experience during transporting your produce?

Lack of transport	Small size of transport	High transport cost	Excessive post harvest loss	Others, specify

Market information

60. Do you have access to market information? 1] Yes 2] No

61. If your answer for Question 68 is Yes, from whom did you get the market information?

Development agents	Kebele administration	Woreda experts	Radio	Brokers	From market	Others, specify

62. What type of information did you get (tick the appropriate)?

Price information	Market place information	Buyers information	Market opportunities	Quality management	Others, specify

63. Who sets your selling price for mango?

Yourself	Buyers	Set by demand and supply	Negotiations	Others, specify

64. What are the problems of marketing in 2014? Rank horizontally

Lack of market	Low price	Lack of storage	Lack of transport	Lack of information	Perishability	Tax	Others, specify

Value addition and cost of marketing

65. Do you make value addition on your mango products before marketing? 1. Yes 2. No

66. If your answer for Question number 79 is Yes, what are those value adding activities that are doing? (Multiple response is possible)

Value adding activities	Tick the appropriate	Respective cost/kg
Grading and sorting		
Cleaning		
Packaging		
Standardizing		
Cleaning		
Others, specify		

67. At what price do you sale one kilo gram of mango? _____ birr

68. What type of marketing cost do you incur during marketing your mango?

Marketing costs	Tick the appropriate	Cost/kg
Transportation cost		
Labor cost		
Material cost		
Others, specify		
Total cost		

69. What amount of net income do you earn from one kilo gram of mango? ____ birr/kg

Post harvest loss of mango

70. Is there problem of post harvest loss? 1. Yes 2. No

71. If yes, how much of your mango produce is goes to loss?-----kg

72. At what stage do you face a high loss of mango?

During production	During harvesting	During marketing	During packaging	Others, specify

73. What are the causes of loss?

Lack of road	Lack of storage	Lack of proper packaging materials	Lack of transportation means	Others, specify

Non-farm and off-farm activities

74. Do you practice other selling activities than mango selling? 1 Yes 2. No

75. How much do you earn from such trading? _____

76. Do you have access to non-farm income? 1. Yes 2. No

77. If your answer is Yes, what are these sources of income?

78. Did you participate on Productive Safety Net programs (PSNP)? 1. Yes 2. No

79. Do you have access to off-farm income? 1. Yes 2. No

80. If your answer is yes, mention the organizations?

81. What is the role of government in facilitating mango production and marketing in the area?

Thank you for your cooperation!!!!!!

II. Traders Interview Schedule

General Information

1. Address: Region _____ Zone _____ Woreda _____ Town _____
2. Type of trade: 1. Wholesaler 2. Retailer 3. Collectors 4. Processor
3. Marital status: 1. Single 2. Divorced 3. Widowed 4. married
4. Family size: _____
5. Educational level of the respondent _____
6. Gender: male _____ female _____
7. What is your main business?

Wholesaling	Retailing	Colleting	Exporting	Processing	Others, specify

8. What are the functions you perform in the type of business in which you have been engaged as mentioned above? _____
9. Do you participate in mango trading year round? 1. Yes 2. No
10. If your answer to Question number 10 is No, at what period of the year do you participate?

When purchase price is low	During high supply	Demand is high	Others, specify

11. Do you practice trading other than mango? 1. Yes 2. No
12. If your answer to Question number 12 is Yes, what do you trade other than mango?

13. What was the amount of your initial working capital when you start mango trade?
_____birr.
14. What is the amount of your current working capital? _____birr
15. What is the source of your working capital? 1. Own 2. Loan 3. Gift 4. Share
5. Others, specify _____

16. If it was loan, from whom did you borrow?

Relative/family	Private money lenders	NGO	Friend	CBE	MFI	Others, specify

17. How much was the annual rate of interest? _____ birr
18. For what purpose do you receive loan?

Purpose of receiving loan	Tick the appropriate
To expand mango business	
To purchase mango transporting means	
To purchase mango packaging materials	
Others, specify	

19. Are you a member of any associations? 1. Yes 2. No
20. If your answer to question number 23 is yes, what services do these associations provide to the members?

Services	Responses (1 =yes, 2 = no)
Loans or credit	
Information on prices	
Co-operative buying	
Transport	
Rules on weight and measures	
Agreement on selling prices	
Insurance	
Others, specify	

21. What transportation means did you use to transport mango? 1. Man power 2. Pack animals 3. Vehicle 4. Cart 5. Others, specify
22. What mode of transport do you use

Stage of movement	Mode of transport
Farm-gate to assembly point	
Assembly point to local market	
Local market-urban/suburban market	

23. If your answer to question number 23 is Yes, mention?
-

24. What kind of asset did you own (multiple responses are possible)?

Assets		No
Warehouse	Separate house	
	Residence	
Vehicle		
Motorcycle		
Bicycle		
Mobile		
Weighting scale		
Shop		
Cart		
Others, specify		

25. Do you have been issued with license for mango trading? 1. Yes 2. No

26. If your answer to question number 26 is yes, who issues trade license?

27. How much do you pay to receive trade license? _____ birr

28. What is the term of payment for the trade license? 1. Annually 2. Semi-annually 3. Quarterly 4. Monthly 5. Others, specify

29. Linkage with commercial value chain actors: (multiple responses are possible)

Farmers	Wholesalers	Retailers	Collectors	Brokers	Processors	Others, specify

30. Mention any organization/institution from which you get marketing services?

Types of services	Organizations	Institutions

31. Is there any organization /institution which influence your overall marketing system? 1. Yes 2. No

32. If your answer to question number 35 is yes, mention those organizations/institutions and how they influence your marketing system?

II. Purchasing practices

33. From which market do you purchase mango (multiple response is possible)? 1. Farm gate 2. Local markets 3. From woreda market 4. From zonal market

34. From whom do you buy mango? (multiple response is possible) 1. Farmers 2. Wholesalers 3. Retailers 4. Collectors 5. Cooperatives 6. Others, specify_____

35. What quantity of mango do you purchase? _____ quintal

36. What type of mango do you purchase?

Type of mango	Reason	Price/kg
Raw mango		
Ripen mango		
Both		

37. What is the term of payment of price determined for the given quantity of mango? 1. Cash 2. Credit 3. Advance payment 4. Others, specify

38. Which market do you prefer to buy most of the time? _____

39. Why do you prefer this market?

Better quality	High supply	Shortest distance	Low purchase price	Others, specify

40. What is the unit of measurement of your purchase?

By sack/quintal	By basket	By weighing scale	By feresula	Others, specify

41. Who sets the purchase price?

You yourself	Set by demand and supply	Sellers	Others, specify

42. Do you consider quality requirement of your customers in purchasing activities?

1. Yes 2. No

43. If your answer to Question number 44 is Yes, what quality requirement do you consider for mango? _____

44. What was your source of information about quality requirement of your customers?

45. In which month (s) volume of mango traded is highest and lowest, respectively? _____

46. What are the months of the year when prices are highest and lowest, respectively?

Selling practices

47. To which market and to whom did you sell mango? Multiple response is possible)

Market	Actors	Quantity sold/quintal	Average price/kg	Percentage share of buyers	Payment 1.cash 2. advanced 3.credit
	Processors				
	Retailers				
	Wholesalers				
	Exporters				
	Cooperatives				
	Hotels and restaurants				
	Consumers				
	Brokers				
	Other, specify				

48. How did you sell your produce

1. Direct to the buyer 2. Through brokers 3. Others, specify

49. When did you sell? (give proportion in percentage)

Selling strategy	Tick the appropriate
Store and sell when prices rises	
Sell as soon as the purchase	

Sell in pieces as buyers comes	
Sale before purchase	
Others, specify	

50. What is your packaging material? 1. Sisal sack 2. Plastic sack 3. Basket 4. Others, specify
51. Do you know the market prices in different markets (on farm, village market and other areas) before you sold your mango? 1. Yes 2. No
52. What is your source of information?

53. What percent of the total mango is sold on local/woreda market? _____percent
54. What percent of your total mango is sold in other market? _____ percent (Addis Ababa, Awassa, etc)
55. What percent of the produce was exported? _____ percent
56. Who sets selling price?

My self	Set by demand and supply	Buyers	Others, specify

57. Are there charges (taxes) imposed by government or community officials at the market? 1. Yes 2. No
58. If your answer to question 63 is yes, what are they and what is the basis of payment?

Types of taxes	Amount (birr)	Bases of payment	Rate of payment (birr)
		Per quintal	
		Simply on daily bases	
		Per track bases	
		Based on purchased value of products	
		Based on sales value of products	

59. Indicate your average cost incurred per kg in the trading process of mango?

Cost component	Costs in birr
Purchase price	
Labor for packing	
Loading and unloading	
Transportation fee	
Sorting	
Storage cost	
Loss in transport and storage	
Telephone cost	

Watch and warding cost	
Other personal expenses	
License and taxes	
Other cost, specify	
Total cost	
Selling price	
Revenue	

60. Is there problem of post harvest loss of mango? 1. Yes 2. No

61. If your answer to question number 73 is yes, please respond the followings?

Causes of loss	Stages of loss	Amount of mango lost

62. Are there problems on mango marketing? 1. Yes 2. No

63. If your answer to question number 69 is yes, what are the problems?

Problems	Items		Expected intervention
	Yes	No	
Credit			
Price setting			
Supply shortage			
Storage problem			
Lack of demand			
Information flow			
Quality problem			
Governance problem			
Lack of government support			
Others, specify			

Thank you for your cooperation!!!!!!!!!!

iii. Consumers Interview Schedule

General information

1. Age of the respondent: _____ years
2. Sex of the respondent: 1. Male 2. Female
3. Education level of the respondent (√): 1. No formal education 2. 6th grade or less
3. 7th to 12th grade 4. Certificate 5. Diploma 6. Degree
4. Marital status: 1. Single 2. Married 3. Widowed 4. Divorced
5. Distance to nearest town: _____ hours or _____ hours walk
6. What is your major means of income? 1. Farming 2. Trade 3. Employment 4. Others
7. How much do you earn per year (estimate based on weekly, monthly income): _____ Birr
8. Do you consume mango fruit? 1. Yes 2. No
9. If your answer for the question number 8 is yes, what forms of mango do you consume?
1. Fresh mango products 2. Processed mango products 3. Both
10. Why do you consume one of the mango forms that you mentioned above?

11. Do you produce and consume or purchase? 1. Purchase 2. Produce 3. Both
12. If you purchase, what is the proportion of your income used for purchase of mango product? _____ birr
13. What amount of mango do you purchase per day? _____ kg
14. What is the price that you pay for one kg of mango? _____ birr
15. At what season do you purchase mango at lower and higher prices? _____ and _____, respectively.
16. What is the reason for the volatility of mango price from one season to another?

17. If you consume processed mango, what kind of processed mango products do you consume? 1. Juice 2. Chutney 3. Puree 4. Jam 5. Nectar 5. Others, specify
18. From where do you get processed mango products?

By processing in own home	Cafeteria and restaurants	Super markets	Mango processing enterprises	Others, specify

19. What is the price that you pay for processed mango? _____ birr/unit (including Value Added Tax)

20. From which actor do you get fresh mango products?

Actors	
--------	--

From mango producers	
From wholesalers	
From retailers	
From rural collectors	
From your produce	
Others, specify	

21. Do you consume mango always? 1. Yes 2. No
22. If no consumption of mango fruit, why? _____
23. At what time do you consume mango in given day and why?
1. During Morning 2. After lunch 3. Afternoon 4. Evening
24. For what purpose do you consume mango?
1] For feeding purpose 2] for entertainment purpose 3] For medicinal purpose
4. As additional food after meal 5] others, specify
25. What kind of quality standards do you need from mango fruit while purchasing it?

26. Is mango that you purchasing meets your quality standards? 1. Yes 2. No
27. Is market for purchasing mango fruit is accessible? 1. Yes 2. No
28. If no what are the problems and who is concerned body for the improvement?

29. What are the constraints hindering you from consumption of mango?

Problems	Tick the appropriate
Supply shortage	
Income shortage	
Lack of storage at home	
High price of product	
Poor product handling	
Lack of market information	
Perishability of the product	
Others, specify	

30. Do you know the benefits of consuming mango product? 1. Yes 2. No

31. If yes, what are those benefits of consuming mango?

32. If yes, what are those problems related with the consumption of mango?

33. Say something about what should be done for further improvement?

Appendix III

Key Informant Discussion with Hort. Experts of the Woreda

Woreda _____

Kebele _____

Date _____

Name of interviewee _____

Title of the interviewee _____

Location and contact information: Region/Zone/Woreda/ Kebele/ P.O. Box/telephone

Type of the organization: Public/Private/NGO

1. Organizational mission, vision and objectives _____
2. What is the role of your organization in mango value chain in the study area?
3. What are the challenges and opportunities you faced in undertaking those roles assigned to your organization?
4. What are the threats for mango extension service and input supply?
5. What are the most important constraining infrastructures affecting mango production and marketing?
6. What are the possible solutions to correct these problems?
7. What is the role of FTCs on mango production and marketing? How?
8. What outputs are achieved on dissemination of mango technologies?
9. Linkage /interaction/ partnership/ coordination between actors